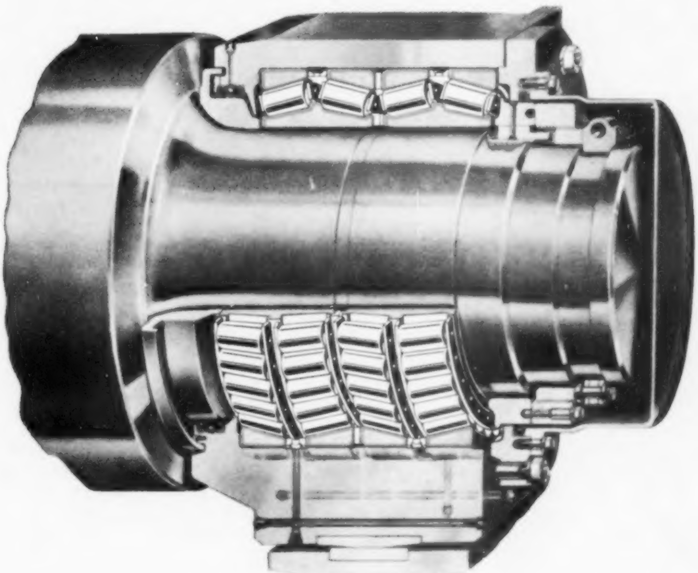
Sheet Metal Industries

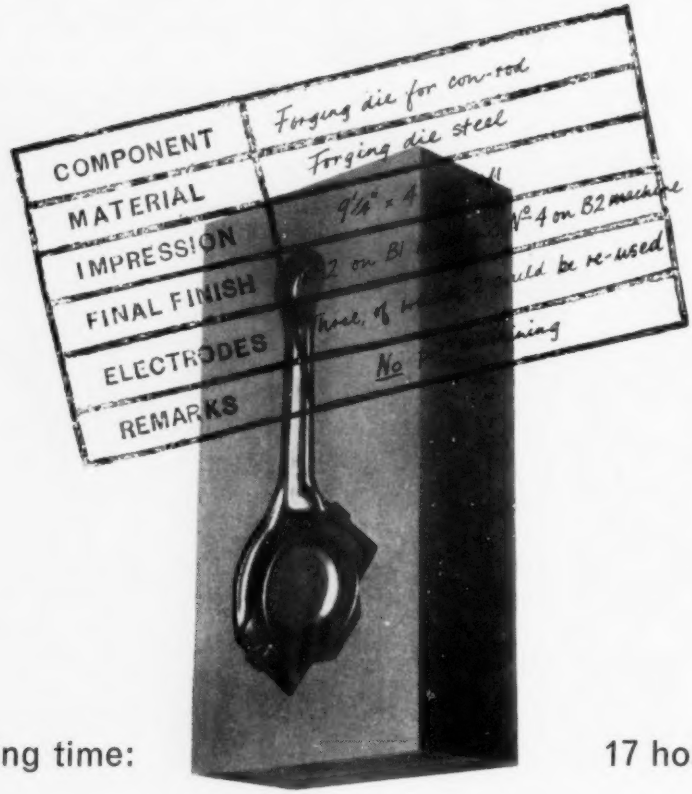
The only Journal in the World wholly devoted to the Manufacture, Manipulation, Fabrication, Welding, Assembly and Finishing of Ferrous and Non-Ferrous Sheet and Strip

VOL. 38 : No. 412 AUGUST 1961 PRICE 2/6



Editorial Contents: 553, 555

Classified Advertisements: 91 to 94



Sparking time: 17 hours

THIS FORGING DIE took 17 hours to make on the new GKN Spark Machine, Model B1. How long would it have taken by other methods?

When you've worked it out, consider the GKN Spark Machine. *It is faster, more accurate, more versatile, more compact and better designed than any other machine of its kind*, yet both installation and running costs are low.

The GKN Spark Machine was designed by the GKN Group Research Laboratory. Not only is it backed by all the Laboratory's technical resources, but *every user of the GKN spark machine can count on regular visits from the makers' technical representative to ensure that he gets the most from his machine.*

Whether you are engaged in forging, wire-drawing or press-tool making, the GKN Spark Machine is something it will pay you to know about. Ask our sales agents for an illustrated brochure on the GKN Spark Machine (Models B1 & B2). Ask them now.

The GKN Spark Machine

DESIGNED BY THE GKN GROUP RESEARCH LABORATORY

WELSH METAL INDUSTRIES LTD.,
Caerphilly, Glamorganshire.

Sales Agents U.K.

M. C. Layton Limited, Abbey Wharf, Mount Pleasant, Alperton, Wembley, Middx.

Rudkin & Riley Limited, Cyprus Road, Aylestone, Leicester.

Alfred Herbert Limited, P.O. Box 18, Red Lane Works, Coventry.

A MEMBER OF THE GKN GROUP OF COMPANIES


IS YOUR
PLANT
GROWING?
TRADE
KEETONA
MARK
SHEET
METAL
SHEARS
Are you thinking of adding a new sheet metal shear to your present plant? Then you're in the Keetona territory—this is the field we've specialised in for years. Streamlined design and fabricated steel construction are two of the outstanding features of Keetona Shears—they're made for today's conditions when you have to work your plant non-stop to get prices down to competitive levels. We'll gladly send full information on the range we make. Hire purchase terms available.
KEETON SONS & CO. LIMITED
KEETONA WORKS, GREENLAND ROAD
SHEFFIELD 9. TEL: SHEFFIELD 42961/4
A MEMBER OF THE FIRTH CLEVELAND GROUP

CRC 13KM

Half a million pounds!

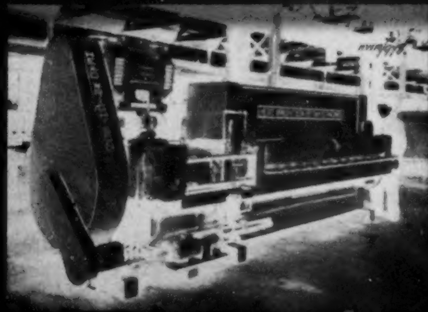
SPENT BY THE STEEL INDUSTRY EVERY TWENTY-TWO HOURS TO KEEP ITSELF UP-TO-DATE

ALMOST everything made in Britain is made either with or by steel. So the steel industry's development plans affect everybody. To keep Britain abreast of parallel developments all over the world large sums are spent. This year they amount to over £200,000,000 – about half a million pounds every twenty-two hours!

This vigorous investment programme is contributing to the prosperity of everyone in this country. Steel is transforming the world we live in because it is strong, cheap, plentiful, easily shaped. Steel can make itself useful in so many different ways. Now flexible and resilient in a spring. Now hard and tough in a cutting tool. Now workable and ductile, so that it can be pressed into the shape of a car body. Steel is the versatile metal — the *essential* metal of modern life.

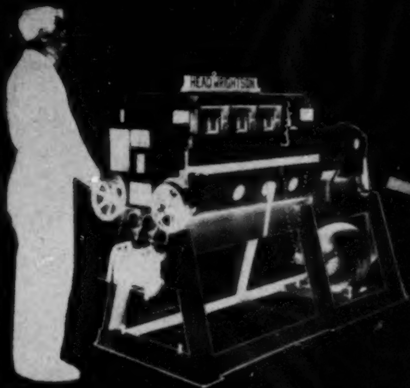
A booklet "Steel in the 1960's" describing the development plans of the British steel industry is available free on application to the Information Office, Steel House, Tothill Street, London, S.W.1.

THIS IS THE STEEL AGE *BRITISH IRON AND STEEL FEDERATION*

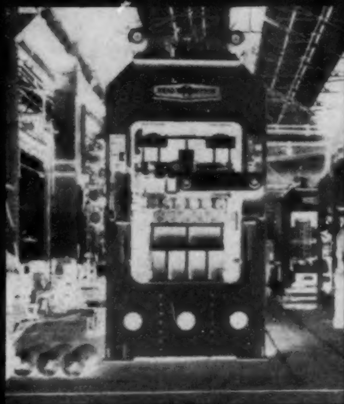


2½" x 2½" x 102" Processor leveller.

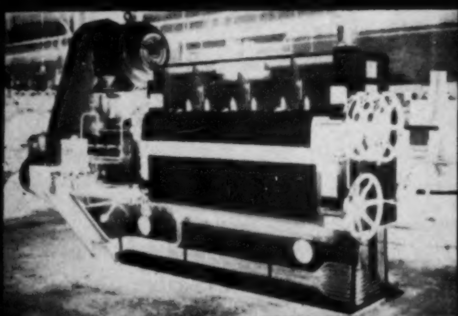
1⅛" x 1⅛" x 36" Pressure regulating roller leveller, with four banks of back-up rolls for levelling aluminium foil.



3½" x 3½" x 60" Pressure regulating roller leveller with pinch rolls.



Three heavy plate levellers capable of levelling plate 12ft wide by 2 inches thick being built at the company's works.



1¾" x 1¾" x 54" Pressure regulating roller leveller.

4½" x 4½" x 84" backed up roller leveller.

Ensure your supplies of metal

WILBRAHAM & SMITH stock the largest variety of metals in London — and deliver on time

STEEL SHEETS FOR ALL USES COLD REDUCED BRIGHT AND HOT ROLLED IN ALL GRADES · BLACK AND GALVANISED · GALVATITE, SPELTAFAST, ZINC PROTECTED—LEADCOATED — TERNECOATED — BLUE PLANISHED — STAINLESS STEEL — **PLATES** HEAVY AND MEDIUM · **TINPLATES** ALL GRADES OF TINNING · **TINNED STEEL SHEETS** TERNEPLATES — BLACKPLATES

COPPER & BRASS SHEETS, STRIP, TUBES, RODS, WIRE, SECTIONS, INGOTS · **PHOSPHORBRONZE & GUNMETAL** · **TIN** INGOT, STRIP, GRANULATED · **MONEL METAL** · **ALUMINIUM & ALLOYS** SHEETS, TUBES, WIRE AND SECTIONS · **ZINC** SHEETS · **STEEL WIRE** BRIGHT, ANNEALED, TINNED, COPPERED, GALVANIZED, WELDING, ETC., COILS, STRAIGHT LENGTHS **STEEL BARS** ROUNDS, FLATS, ANGLES, BLACK & BRIGHT.

WILBRAHAM & SMITH

W & S

WILBRAHAM & SMITH LTD.

260 GRAY'S INN ROAD, LONDON, W.C.1.
Telegrams: "METINGEN, KINCROSS, LONDON"
Telephone: TERMINUS 6400 (12 lines)

ROBERTSON

in FRANCE

Photograph by courtesy of Compagnie Française des Métaux.

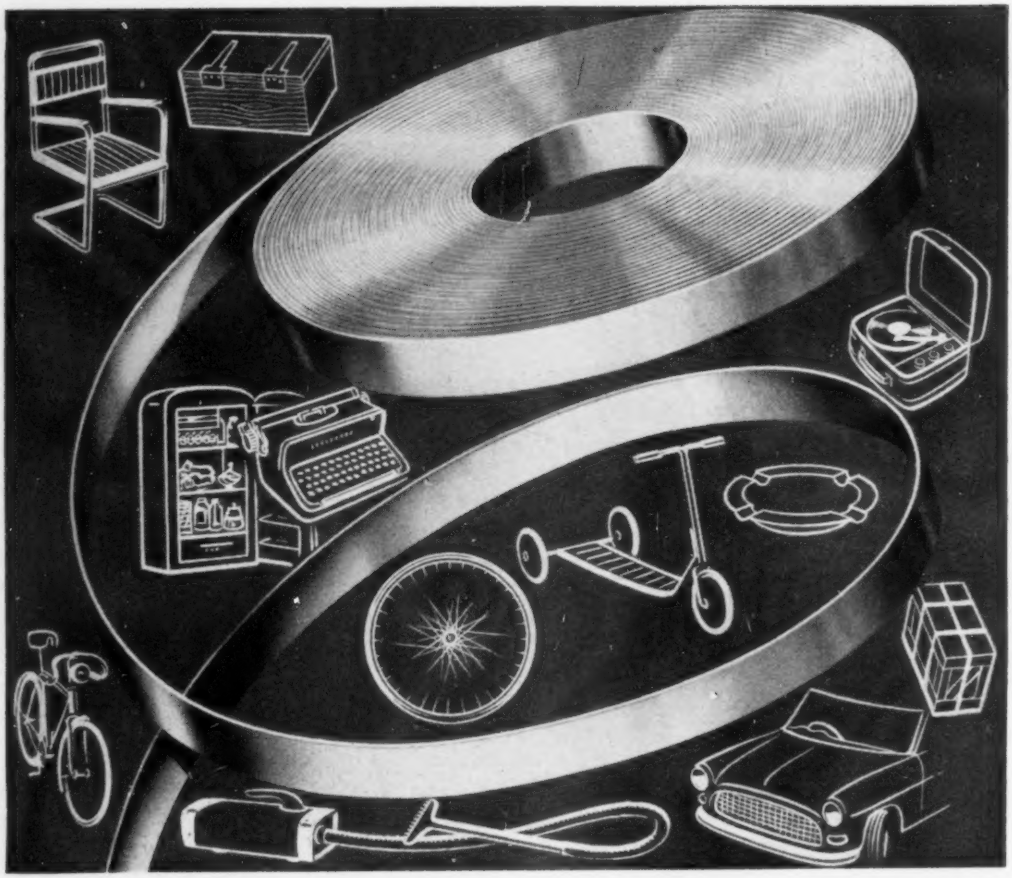
Two-high Reversing Hot Mill for aluminium installed by Robertsons at the works of Compagnie Française des Métaux.

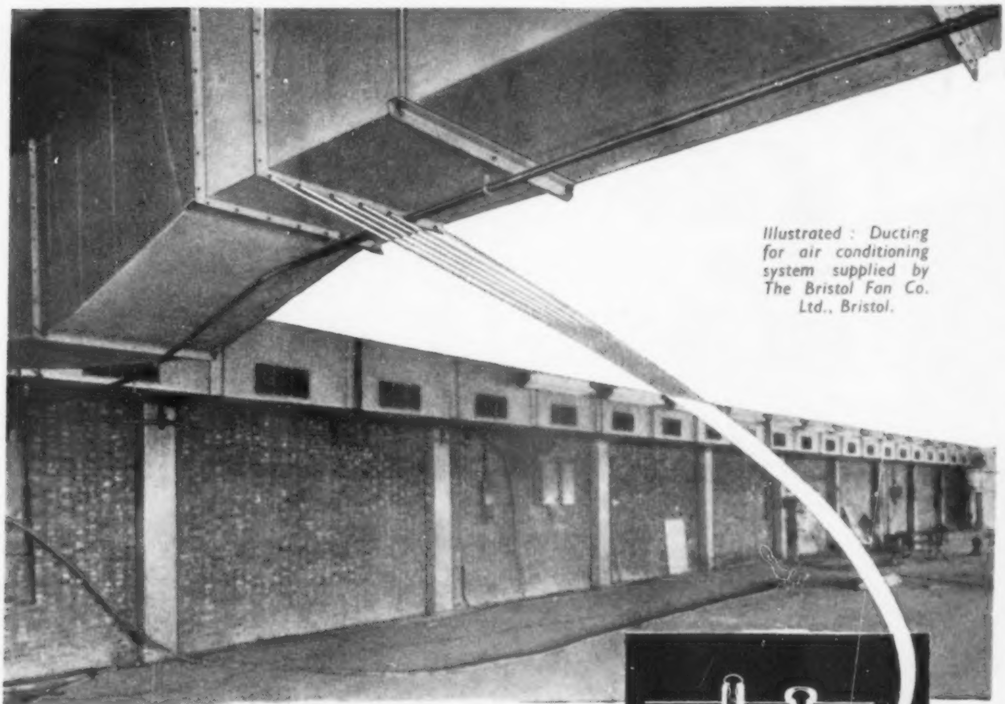
Rolls 32" × 64". Speed 400 feet per minute.

W. H. A. ROBERTSON & CO. LTD.
BEDFORD · ENGLAND

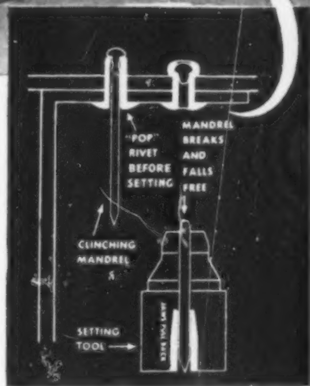
LICENSEES FOR THE BUILDING OF SENDZIMIR COLD REDUCTION MILLS AND PLANETARY HOT MILLS, HALLDEN GUILLOTINE AND ROTARY FLYING SHEAR MACHINES, AND TORRINGTON METAL WORKING MACHINERY. WT. 338R

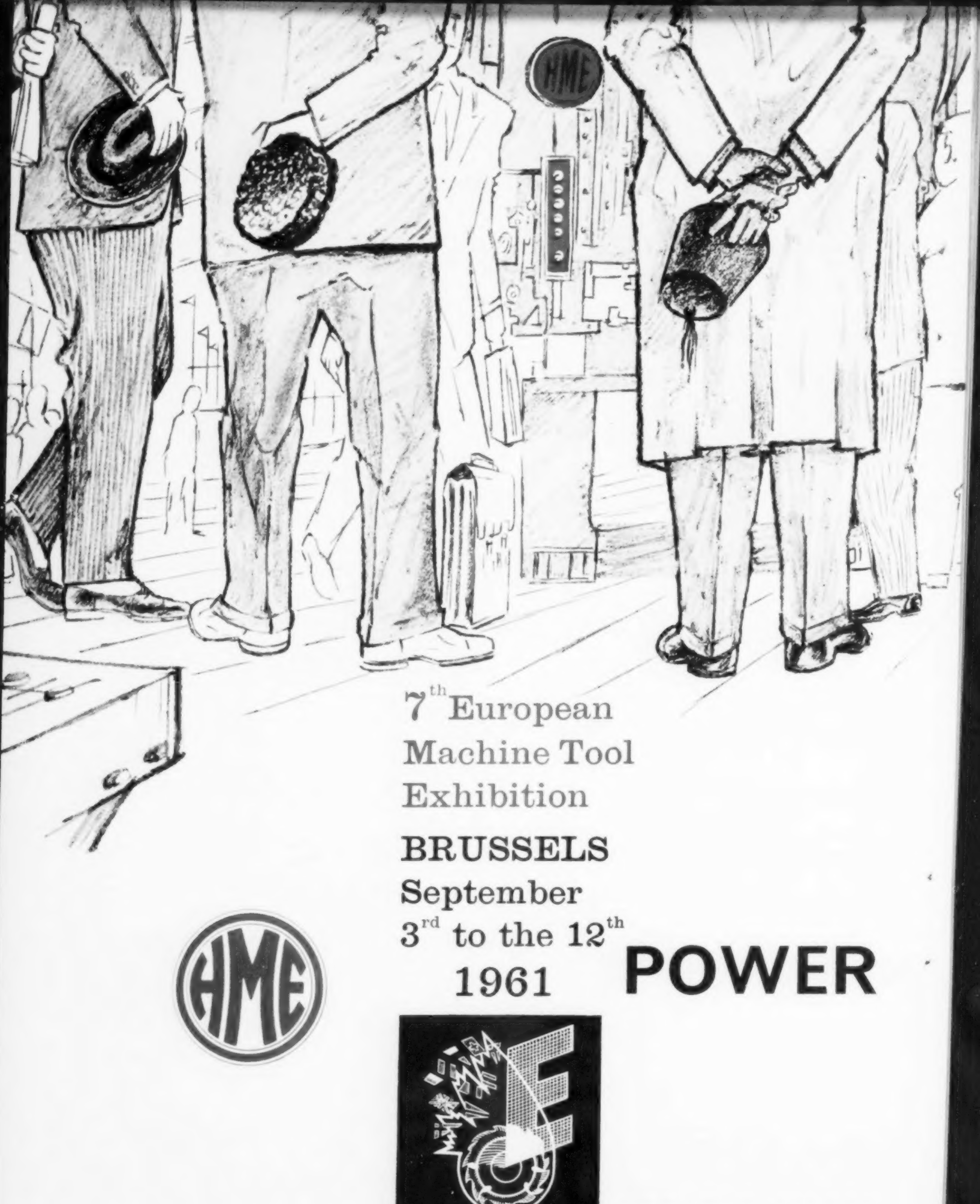
FALKS "Truncolite" is in 10 ft. lengths and can be used with 4, 5 or 8 ft. fluorescent fittings, single or twin lamps, with or without reflector
FALKS "Truncolite" for Large-scale Industrial Lighting
FALKS "Truncolite" provides you with an infinitely extensible and widely adaptable base for fluorescent lighting schemes using continuous trunking. "Truncolight" is ideal for all large-scale industrial lighting applications.
FALKS, the long established lighting specialists, designers and manufacturers of all types of fittings. Lighting Engineering Services freely available.
We welcome your inquiries
FALKS
THERE'S A MODERN FALKS FITTING FOR EVERY PURPOSE
91 FARRINGDON ROAD, LONDON, E.C.1. HOLborn 7654. London Showrooms: 20/22 MOUNT STREET, PARK LANE, W.1. Mayfair 5671/2
AP 124

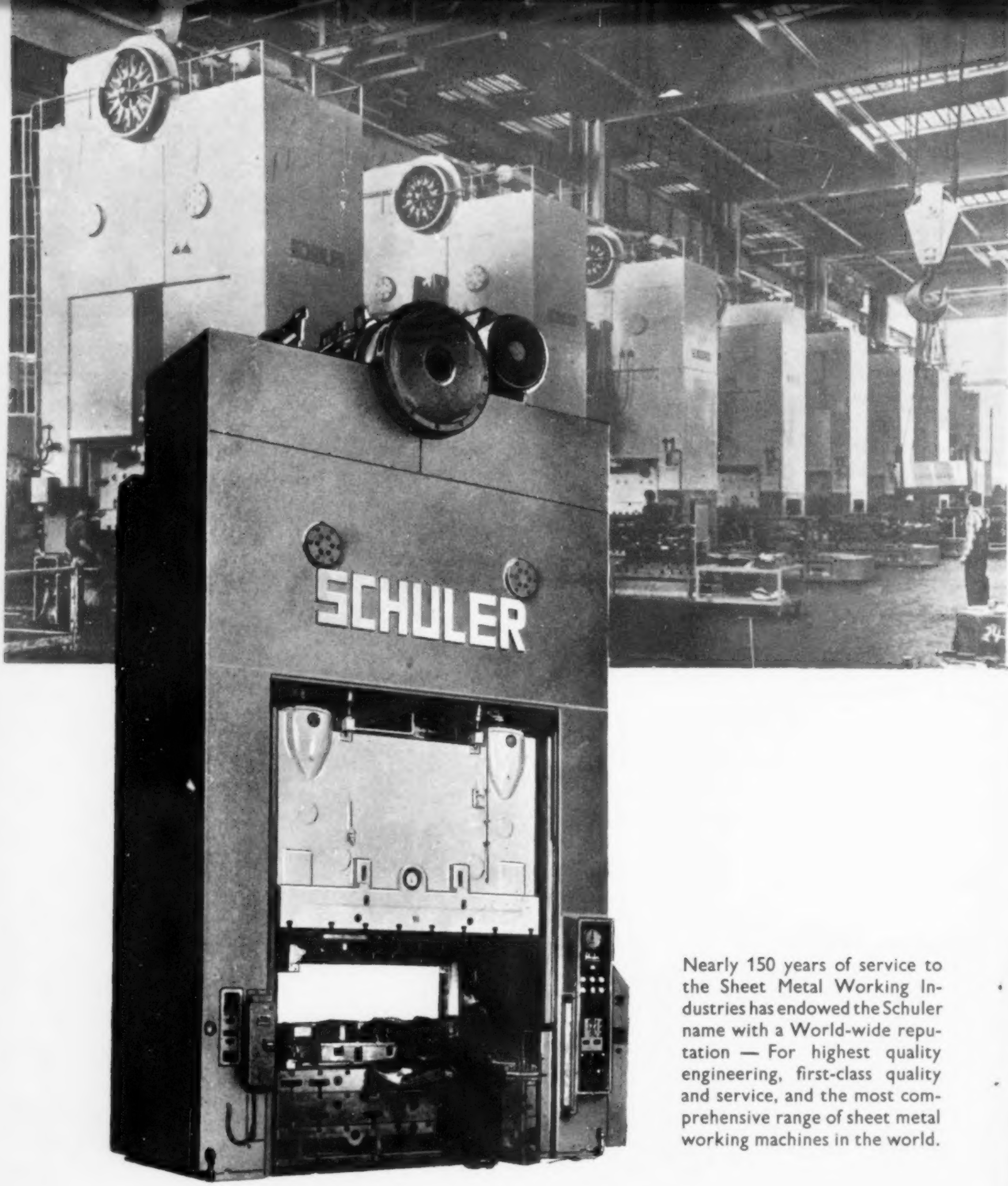


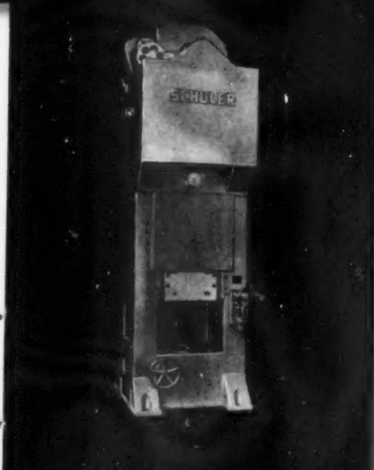


Illustrated : Ducting for air conditioning system supplied by The Bristol Fan Co. Ltd., Bristol.

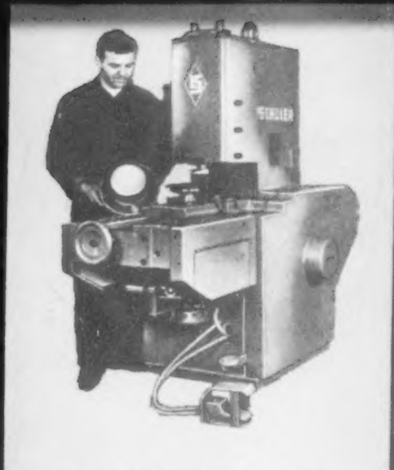



HME
7th European
Machine Tool
Exhibition
BRUSSELS
September
3rd to the 12th
1961
POWER
HME
BRUXELLES
HORDERN, MASON


SCHULER

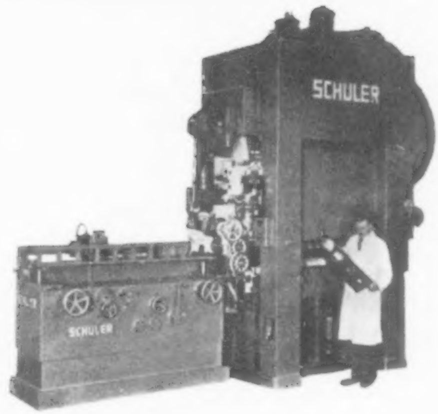


Wide Frame Toggle Drawing Presses

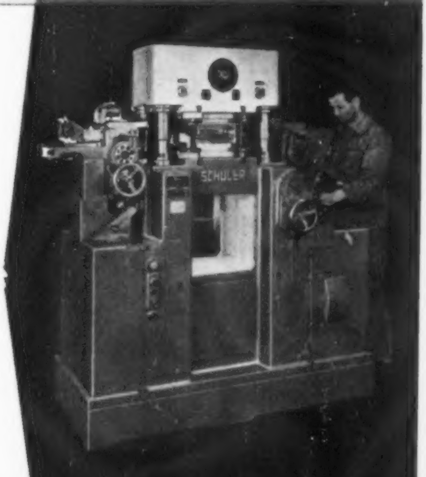


Notching Machines in 5 sizes

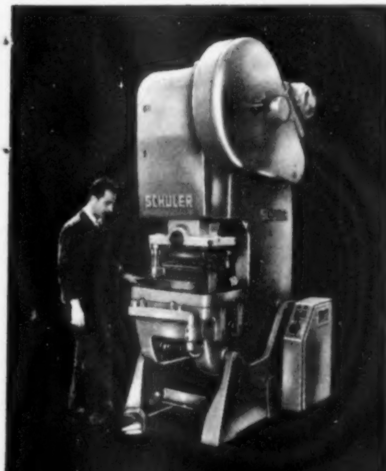
Wide Frame Toggle Drawing Presses



HIGH SPEED BLANKING PRESSES

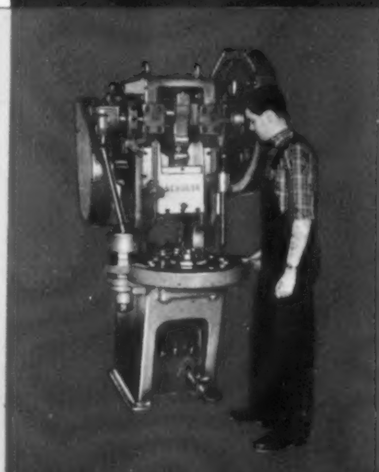


Four-Pillar High Speed Dieing Presses



C-Frame Power Presses

Transfer Presses


Dial Feed Presses

The answer to one-sided assembly fixing–

GKN

introduce new low-cost, high-speed fasteners, designed for fixing from one side of an assembly. Simple, positive, robust and time-saving fasteners for general application in all industries.

No tapping
Assembly from one side
Insulated fixing
High strength/weight ratio
No special tools required
Vibration-proof
Clips in position and cannot fall out
Dust and waterproof
Low cost

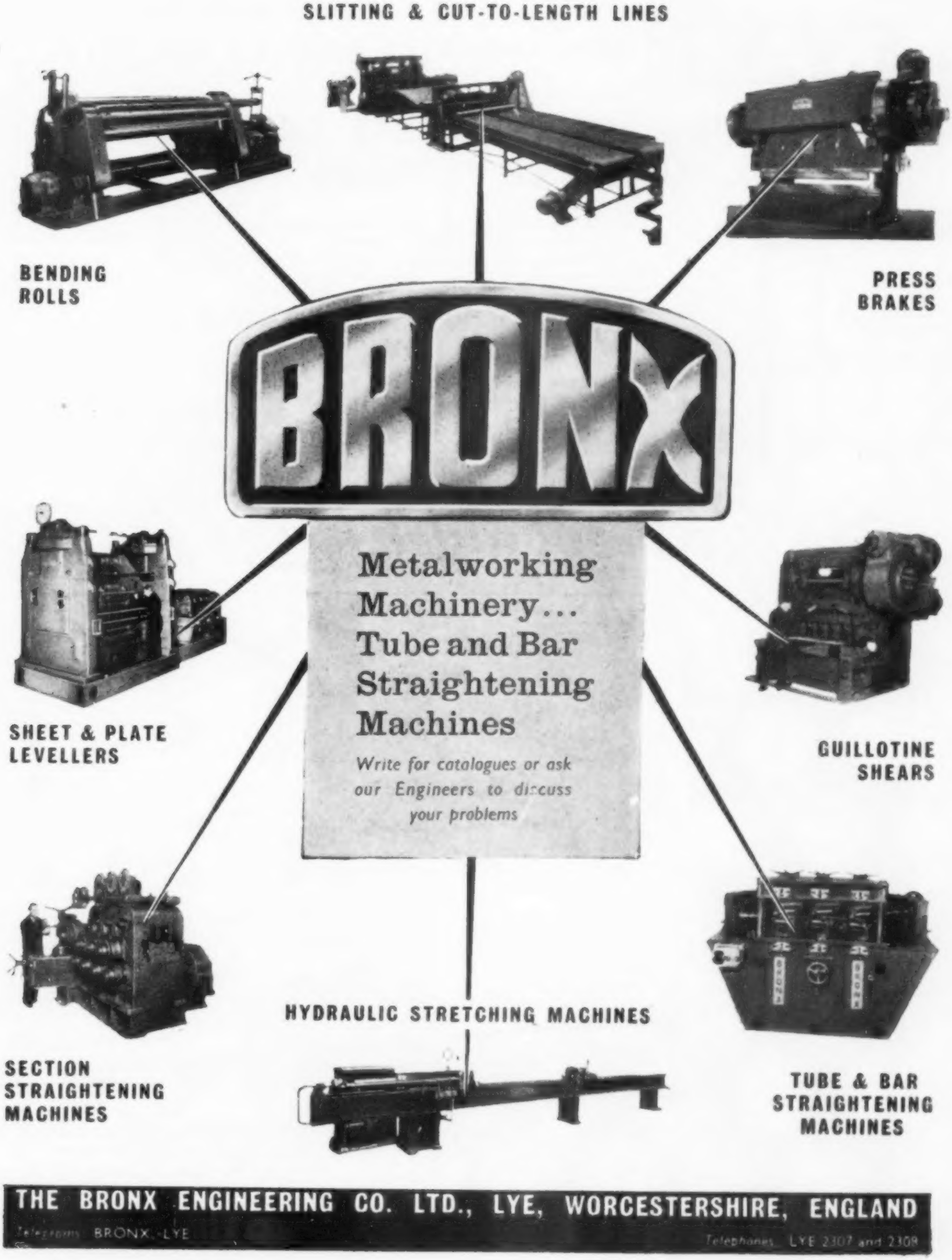
Full technical details on request.

IF IT'S A MATTER OF FIXING ONE THING TO ANOTHER—GET IN TOUCH WITH **GKN**

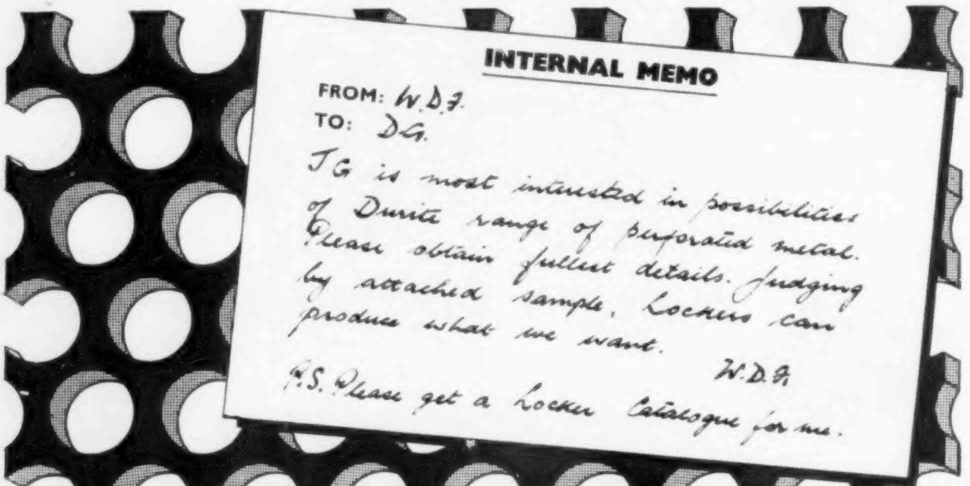
A MEMBER OF THE GKN GROUP OF COMPANIES

GEORGE GOODMAN LTD

ROBIN HOOD LANE • BIRMINGHAM 28 • TELEPHONE: SHIRLEY 4491



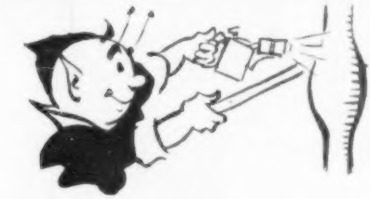
SLITTING & CUT-TO-LENGTH LINES
BENDING ROLLS
PRESS BRAKES
BRONX
Metalworking Machinery... Tube and Bar Straightening Machines
Write for catalogues or ask our Engineers to discuss your problems
SHEET & PLATE LEVELLERS
GUILLOTINE SHEARS
SECTION STRAIGHTENING MACHINES
HYDRAULIC STRETCHING MACHINES
TUBE & BAR STRAIGHTENING MACHINES
THE BRONX ENGINEERING CO. LTD., LYE, WORCESTERSHIRE, ENGLAND
Telegrams BRONX, LYE
Telephones LYE 2307 and 2308



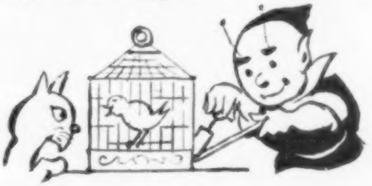
INTERNAL MEMO
FROM: W.D.J.
TO: D.G.
J.G. is most interested in possibilities of Durite range of perforated metal. Please obtain fullest details. Judging by attached sample, Lockers can produce what we want.
W.D.J.
P.S. Please get a Locker Catalogue for me.

Whether you solder to

(a) keep things IN ......



(b) keep things OUT ....



(c) keep things GOING...

success is certain with

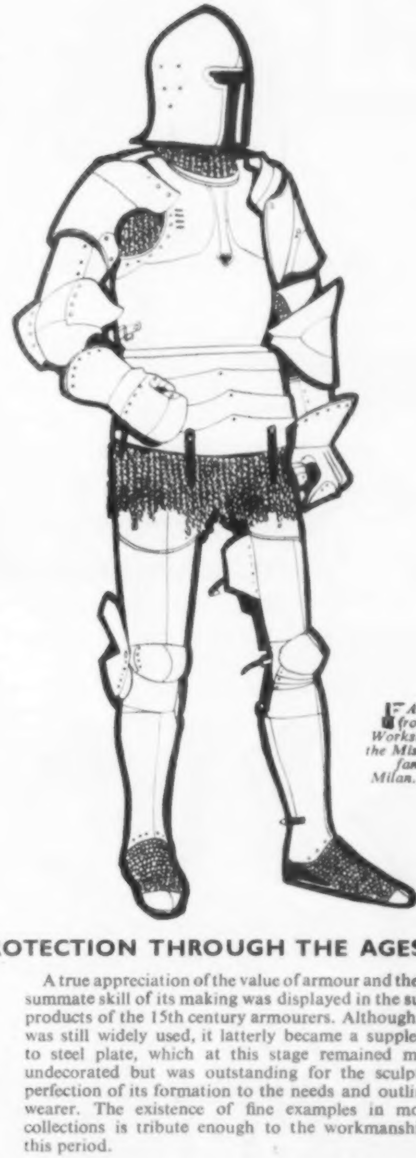
FLUXITE

You can't go wrong with FLUXITE. Every engineer and mechanic confronted with a soldering job knows FLUXITE is the flux that never lets him down. FLUXITE's great popularity is proof positive of its qualities.

M.P. 90

FLUXITE LTD

BERMONDSEY STREET · LONDON S.E.1 · HOP 2632



Armour from the Workshop of the Missaglia family of Milan. 1450.

PROTECTION THROUGH THE AGES—2

A true appreciation of the value of armour and the consummate skill of its making was displayed in the superb products of the 15th century armourers. Although mail was still widely used, it latterly became a supplement to steel plate, which at this stage remained mainly undecorated but was outstanding for the sculptured perfection of its formation to the needs and outline of wearer. The existence of fine examples in modern collections is tribute enough to the workmanship of this period.

SHIMWELL & Co. LTD

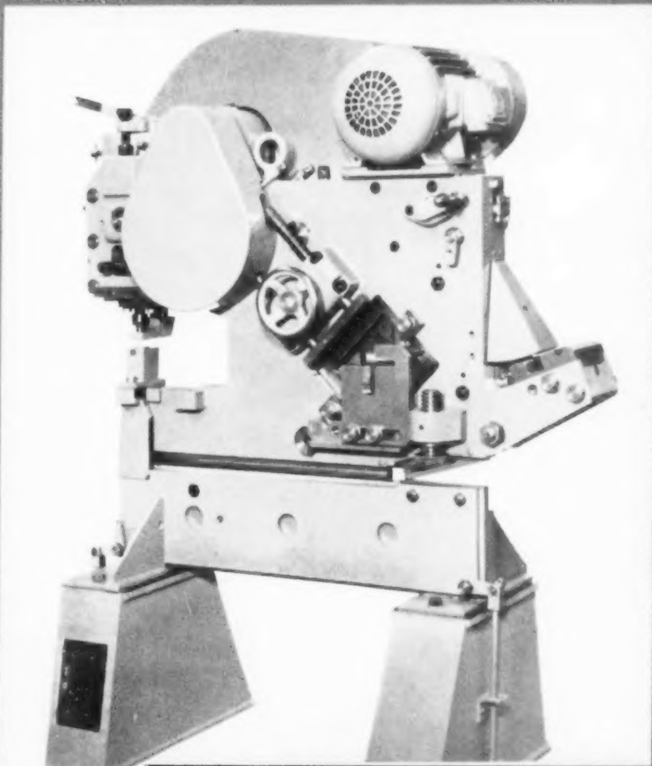
"LONDON" BRAND

STEEL SHEETS — TINNED OR LEADCOATED BY THE HOT-DIPPED PROCESS FOR ENDURING PROTECTION AGAINST CORROSION.

WELLINGTON ROAD, LEYTON, LONDON, E.10

TEL: LEYTONSTONE 2281-3

New from **PELS**



MKC10 STEELWORKER

A new model incorporating all welded steel frame, hand and foot operation, interchangeable notching head and cropper carrier, twin spindle 'down-holder' and even sturdier construction.

Angle and plate punching with solid die-to-floor support. Capacity—13/16" dia. through 3/8" or 11/16" dia. through 1/2".

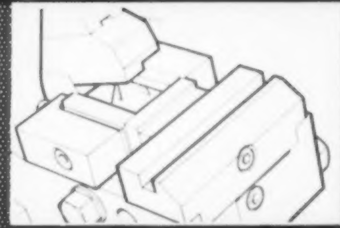
From the Pels stable at a highly competitive price . . .

Write for full quotation and capacities.

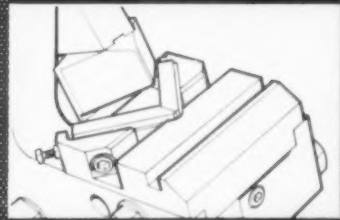
PELS

HENRY PELS & CO. LTD.
32-38 OSNABURGH ST., LONDON, N.W.I
Telephone: EUSTON 4113 *Cables*: RYPELSNEH, LONDON

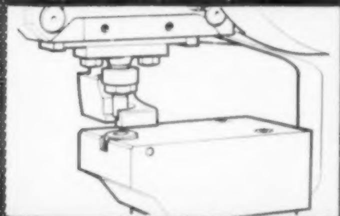
NRP 3457



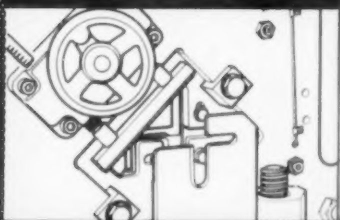
Square notching up to 3/8" thickness.



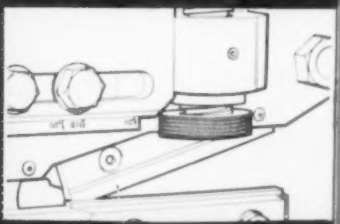
Mitre notching up to 5/16" thickness. Alternative to square notcher or supplied extra if both required.



Optional die saddle for punching into flanges of joists and channels.

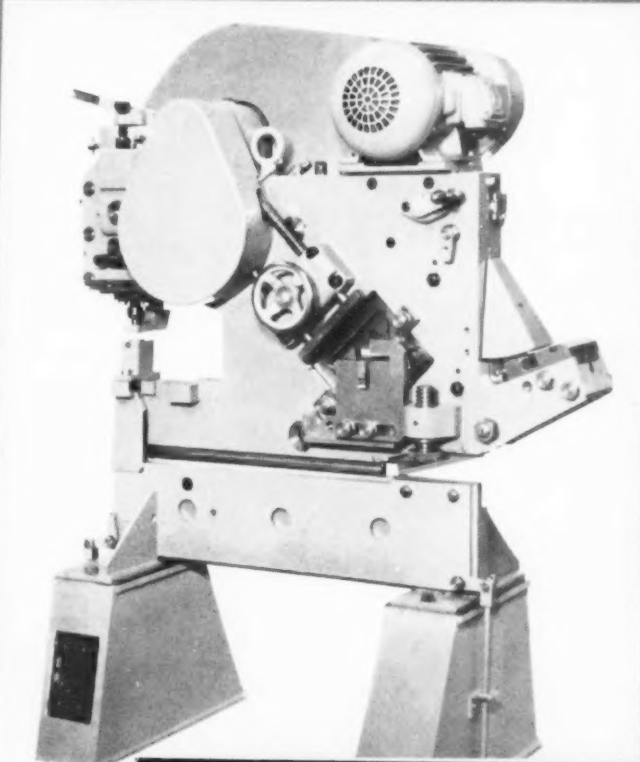


Cropping up to 3" × 3" × 3/8" angles and tees.

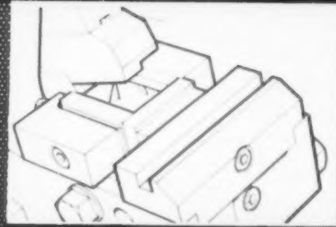


Shearing up to 3/8" thickness.

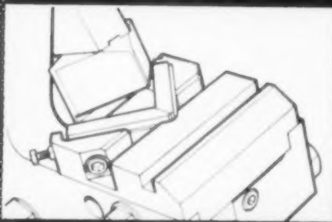
New from PELS



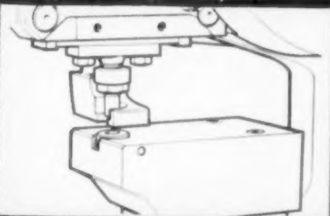
MKC 10 STEELWORKER



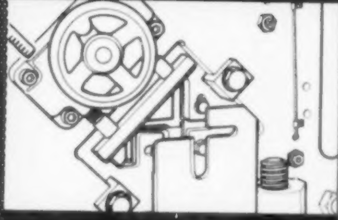
Square notching up to 3/8" thickness.



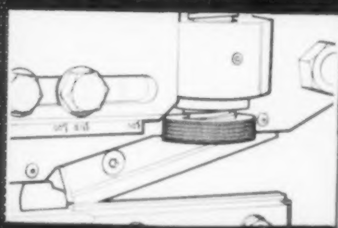
Mitre notching up to 5/16" thickness. Alternative to square notcher or supplied extra if both required.



Optional die saddle for punching into flanges of joists and channels.



Cropping up to 3" × 3" × 3/8" angles and tees.



Shearing up to 3/8" thickness.

A new model incorporating all welded steel frame, hand and foot operation, interchangeable notching head and cropper carrier, twin spindle 'down-holder' and even sturdier construction.

Angle and plate punching with solid die-to-floor support. Capacity—13/16" dia. through 3/8" or 11/16" dia. through 1/2".

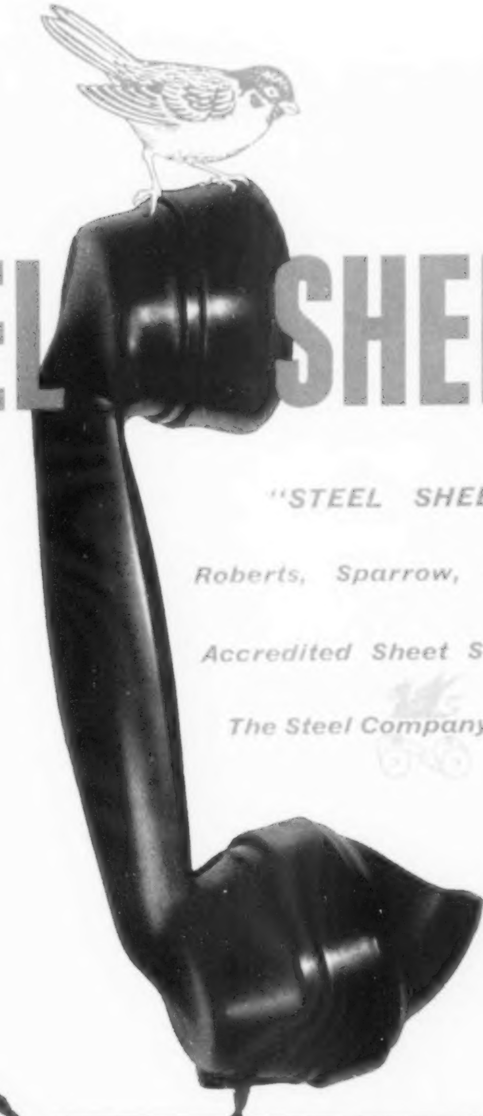
From the Pels stable at a highly competitive price . . .

Write for full quotation and capacities.

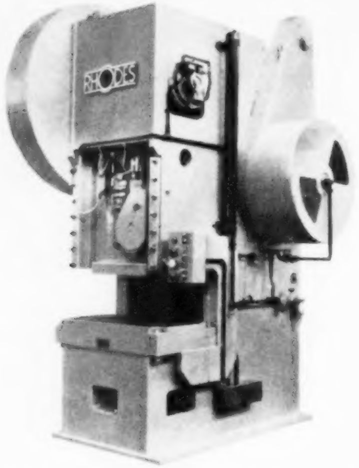
PELS

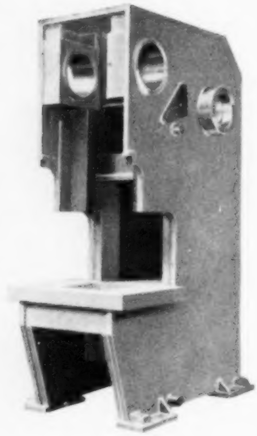
HENRY PELS & CO. LTD.
32-38 OSNABURGH ST., LONDON, N.W.1
Telephone: EUSTON 4113 *Cables*: RYPELSNEH, LONDON

NRP 3497

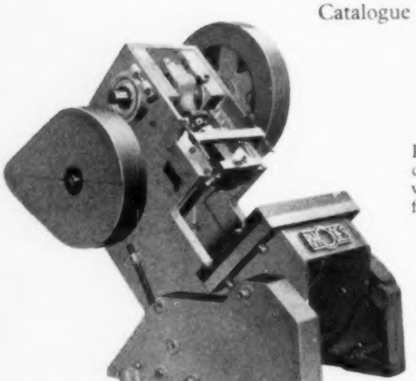


RHODES C-FRAME PRESSES . . . .

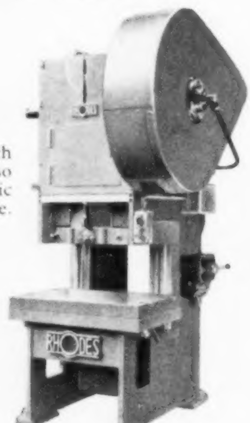




The sturdy fabricated one-piece steel frame of Rhodes C-Frame Presses is only one aspect of their merits—full details of all their constructional and operational features are contained in Catalogue RFP-60.



Rhodes RF series presses are all inclinable, up to Size RF75. Inclining mechanism can be motorised.

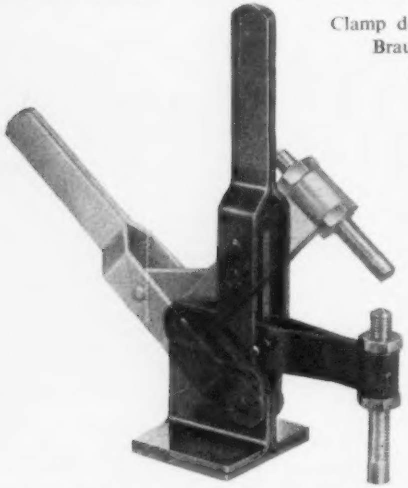


Press with friction clutch control — available also with electro-pneumatic friction clutch and brake.


with INDESTRUCTIBLE
STEEL FRAMES
pneumatic balancing
coupling assembly
lubrication
"Rhodes" electro-pneumatic friction clutch and brake . . .
Full particulars in Publication
RFP-60
JOSEPH RHODES & SONS LIMITED
WAKEFIELD · ENGLAND · Telephone: 2756 (3 lines)
LONDON· Norfolk House, Laurence Pountney Hill, E.C.4. Telephone: Mansion House 7746-7747

RP 12

SAVE TIME ON CLAMPING



Clamp down on time wasted in screwing and unscrewing. Brauer TOGGLE Clamps give the quickest holding action for welding and sheet metal fabrication. Also drilling, bonding, brazing, etc. The toggle clamp principle gives positive and accurate anchorage of the workpiece, whatever the material or application.

FOR QUICKNESS AND POWER USE CLAMPS BY BRAUER

Makers of Europe's largest range of Toggle Clamps

[illegible] of the Cope Allman Group

Send now for illustrated catalogue and technical data to Dept. 24.

F. BRAUER LTD., Harpenden, Herts.

TELEPHONE: HARPENDEN 3603

FWS

L. A. HUTTON & CO. LTD

— EX STOCK —

COILS or LENGTHS.
COMPREHENSIVE RANGE of WIDTHS, and GAUGES

POUND ROAD, CHERTSEY, SURREY

Telephone: CHERTSEY 3451/2/3

SUMMERS "GALVATITE" EX STOCK, TO YOUR WIDTH, IN COILS OR LENGTHS

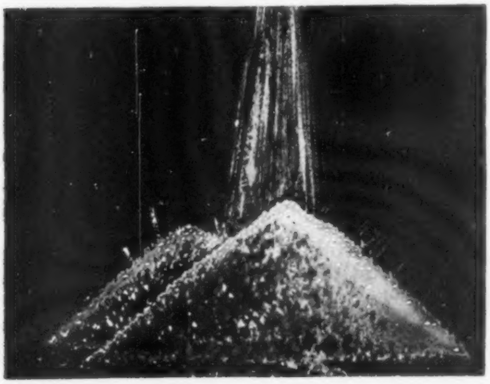
HOMMEL'S TITEWITE

...A COMPLETELY MODERN PORCELAIN ENAMEL FRIT

Universal acceptance of this vastly improved water-quenched granular frit has readily established a name for TITE-WITE throughout the industry.

Rigid QUALITY CONTROL exercised in the processing of this white frit guarantees uniformity. Engineers endorse the technical excellence, workability, and beauty of Tite-Wite finishes for all purposes.

Let us show you how Tite-Wite can answer your problems. Contact us today.



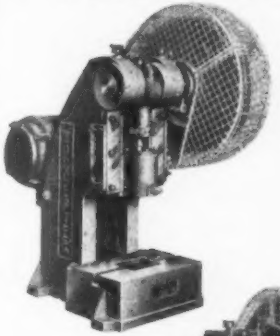
"The World's Most Complete Ceramic Supplier"

THE O. HOMMEL CO.

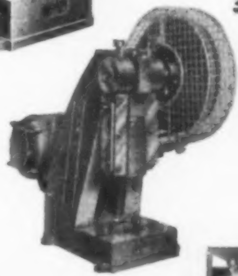
PITTSBURGH 30, PA., U.S.A.

WEST COAST: 4747 E. 49th St., Los Angeles, California

WORCESTER
BENCH PRESSES

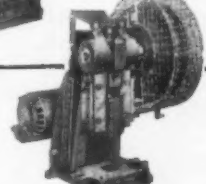


6 TON



3 TON

2 TON



Specifications

CAPACITY	6 TON	3 TON	2 TON
Overall Dimensions:	35"H×15"W×25"	28"H×12"W×24"	22"H×10"W×21"
Fixed stroke:	1¼", ¾" or ½"	1" or ½"	⅜" or ½"
Ram adjustment:	1¼"	1"	¾"
Open tool height:	8"	6"	4⅛"
Throat:	4½"	3½"	2⅜"
Bed size:	12"W×8½"	9"W×6½"	7"W×5⅜"

Optional extras: Single stroking clutch mechanism. Floor stands. Crankshaft extension for auto-feed drive.

OFFER **We will gladly advise you upon the suitability of Worcester Presses for your job upon receipt of full particulars with, if possible, samples of the work to be done.**

Send for free illustrated price lists

JONES & ATTWOOD LTD.

Dept. W.3

STOURBRIDGE WORCESTERSHIRE

Telegrams: HEAT, Stourbridge Telephones: Stourbridge 5106-7-8

Capstan and automatic work and sheet metal pressings in any metal, any finish, any quantity.
GRIFFITHS, GILBART, LLOYD,
AND COMPANY LIMITED
EMPIRE WORKS,
PARK ROAD,
BIRMINGHAM, 18
TELEPHONE NORthern 6221

PERFORATION
PERFORATED METALS
PERFORATED ZINC
WIRE WEAVING
AND NAMEPLATES
W. BARNS & SON (HOLLOWAY) LTD
Successors to W. BARNS & SON – Established 1860
GLOBE WORKS, QUEENSLAND RD.
HOLLOWAY, LONDON, N.7.
Telephone: NORTH 3347-8
Telegrams: PERFORATION HOLWAY LONDON

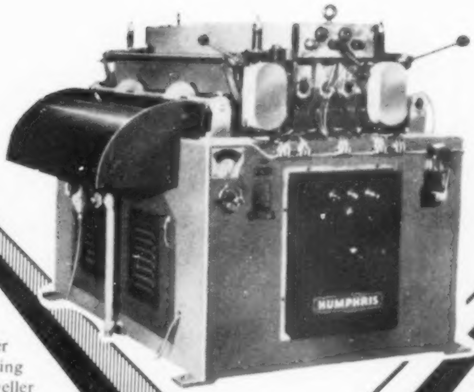
THE SCIENTIFIC APPROACH

Multi-channel oscillograms being made of the performance under load of a Cowlishaw Walker steel frame eccentric press at the Manchester Works of Associated Electrical Industries Ltd. This meticulous graphical analysis of the performance of this new range of eccentric presses of advanced design guarantees to the user:—higher productivity, better pressings and longer tool life.

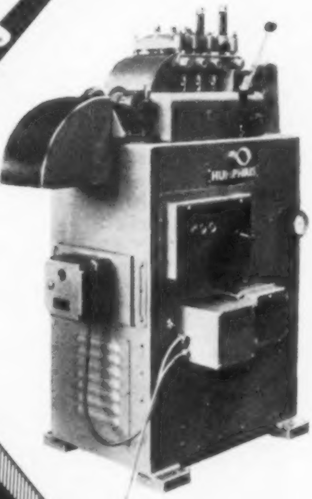
COWLISHAW WALKER AND COMPANY LIMITED

BIDDULPH, STOKE-ON-TRENT · *Phone: Biddulph 3254 · London Office: 117 Victoria Street, Westminster, S.W.1. Victoria 5472*

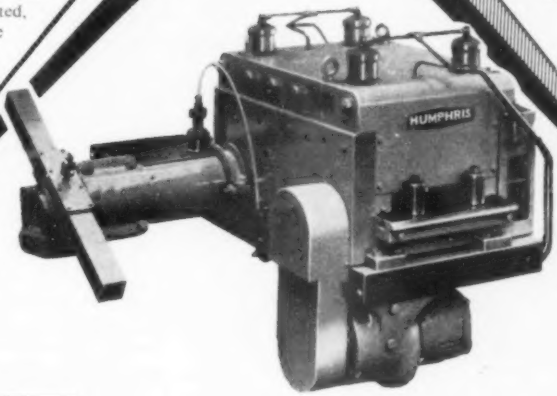
The three machines illustrated embody new techniques for combining the functions of feeding and levelling coiled strip. The upper illustration is of a free standing electro-mechanical feeder leveller suitable for press feed or cut-off lines. Illustrated right is a smaller, floor-



NEW Machines for Strip Levelling & Feeding



mounted machine, embodying a different feeding principle, but with similar application. The lower illustration shows a new combined roll feed and leveller, press mounted, with rack and pinion drive and threading motorisation, suitable for handling very thick material.



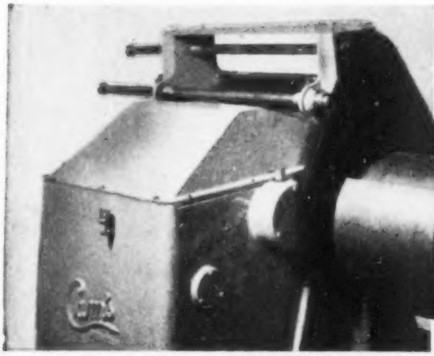
pressmaster

exponents of advanced mechanisation

HUMPHRIS & SONS LTD · POOLE · DORSET

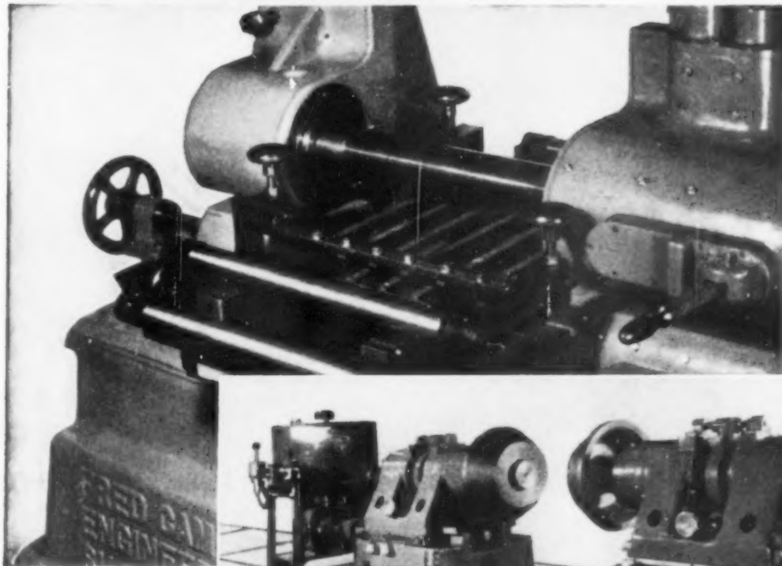
TELEPHONE : POOLE 1800 TELEGRAMS : HUMPSONS

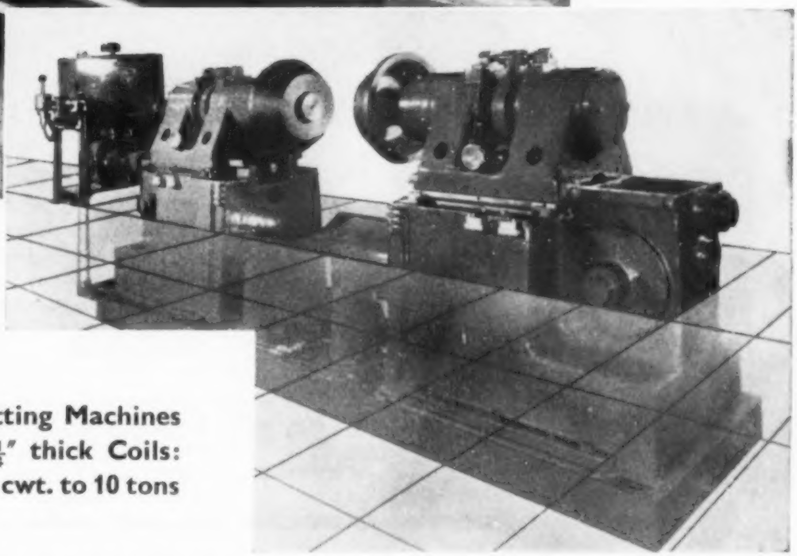
HUMPHRIS



Cam's
of
SHEFFIELD

Auxiliary Equipment for Strip Mills, Box and Tube Works





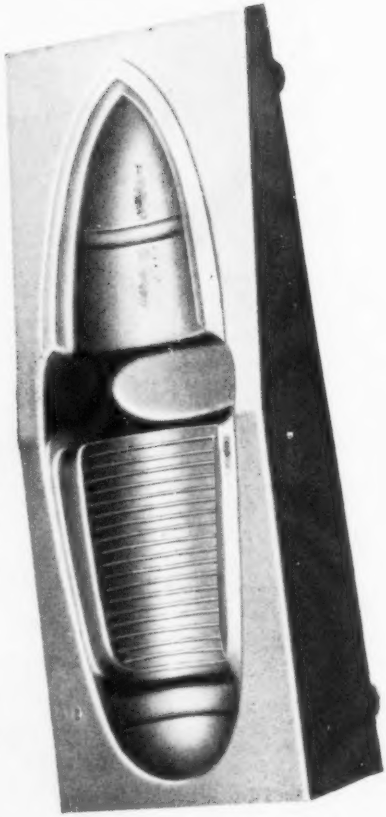
Full range of Slitting Machines for .005″ up to ¼″ thick Coils: 6″-48″ wide and 1 cwt. to 10 tons

FRED CAM (ENGINEERS) LTD., 5 JOHN ST., SHEFFIELD 2

Telegrams: "Camshef, Sheffield 2" *Telephone Nos. 51824 and 52339.*

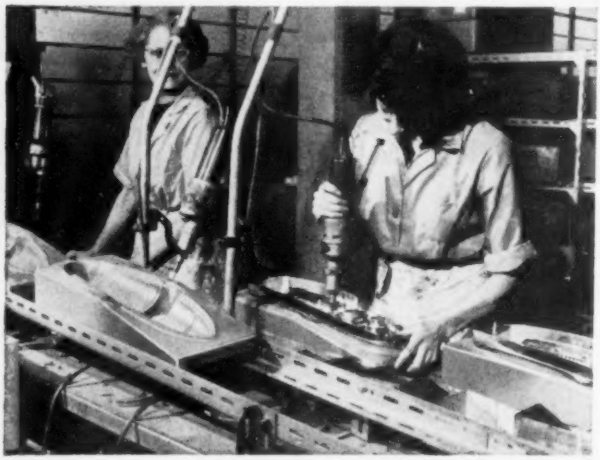
ARALDITE

CUTS TOOL ROOM COSTS



Araldite resins enable manufacturers to produce, speedily and at low cost, assembly jigs which are replicas of original patterns. These jigs can be cast at room temperature, and as there is negligible shrinkage on setting they possess high dimensional accuracy. Araldite is available in forms which will provide any required degree of hardness, and a resilient surface is often used to prevent damage to highly finished products. Araldite jigs are tough, durable and require no maintenance, either in use or in storage. Also, they are much lighter and easier to handle than their metal counterparts.

Araldite can probably save you money on your own assembly lines. Let us send you our booklet " Araldite Resins for Tooling ".



Araldite faced jigs are used by Butlers Ltd, Birmingham, in the assembly of combined tail and stop lamp shells for cars.

Araldite epoxy resins are used

For casting high grade solid electrical insulation

for impregnating, potting or sealing electrical windings and components

for producing glass fibre laminates

for producing patterns, models, jigs and tools

as fillers for sheet metal work

as protective coatings for metal, wood and ceramic surfaces

for bonding metals, ceramics, etc

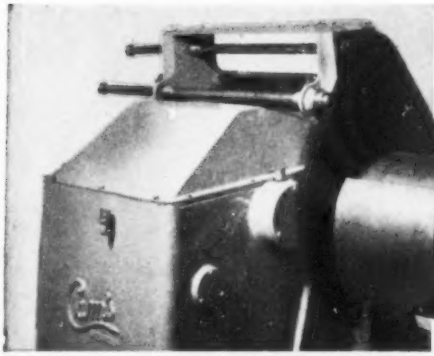
Araldite *epoxy resins*

Araldite is a registered trade name

C I B A (A.R.L.) LIMITED

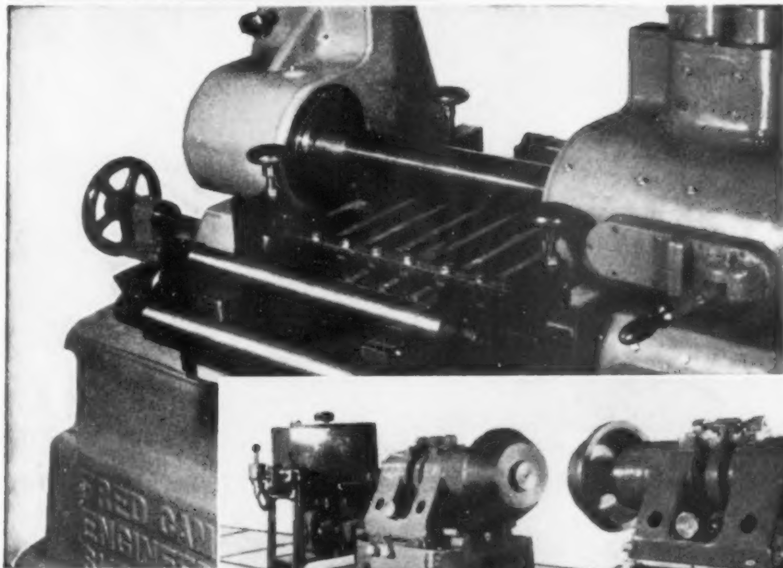
Duxford, Cambridge. Telephone: Sawston 2121

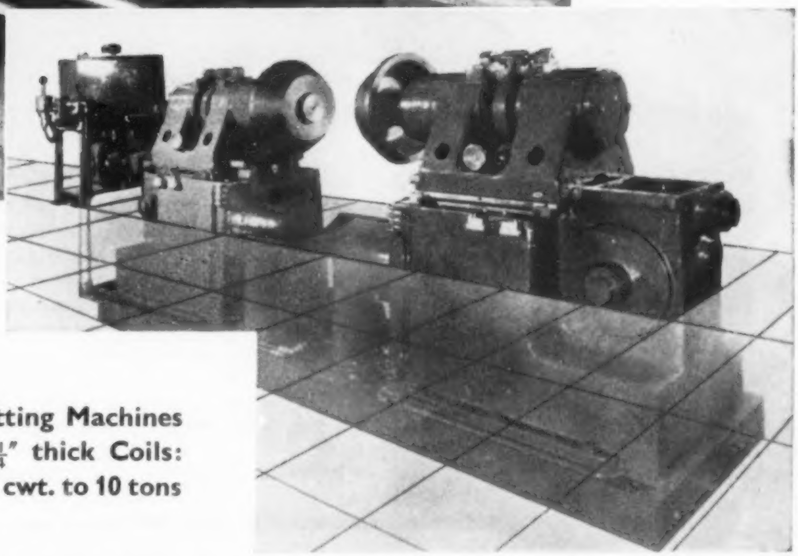
AP590A



Cam's of SHEFFIELD

Auxiliary Equipment for Strip Mills, Box and Tube Works





Full range of Slitting Machines for .005″ up to ¼″ thick Coils: 6″-48″ wide and 1 cwt. to 10 tons

FRED CAM (ENGINEERS) LTD., 5 JOHN ST., SHEFFIELD 2

Telegrams: "Camshef, Sheffield 2"   *Telephone Nos. 51824 and 52339.*

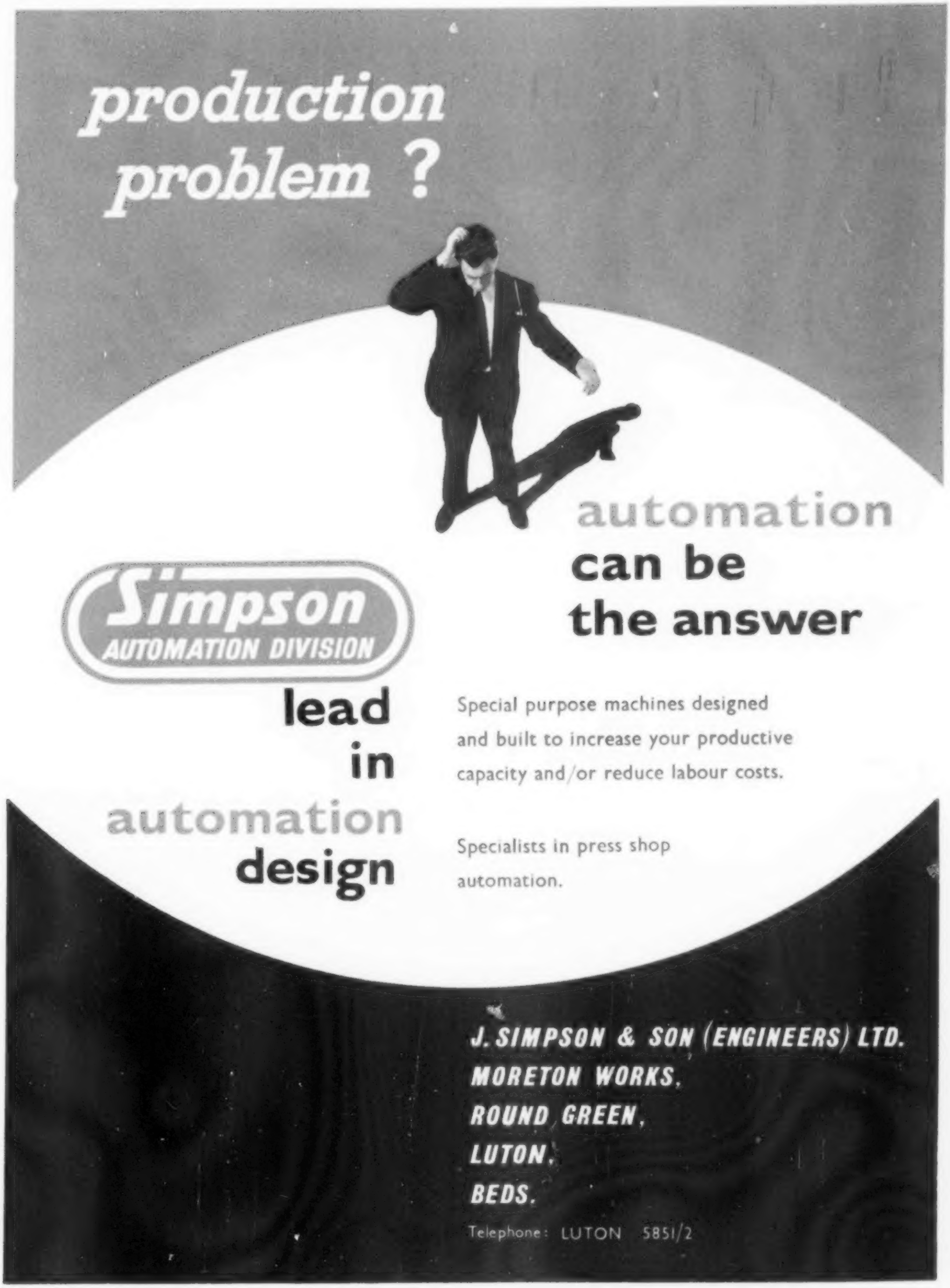
the luxurious
HANOVIA
TURBOFLO heater
employs **PLASTEEL**
to enhance an
elegantly functional
3,000w heater/cooler

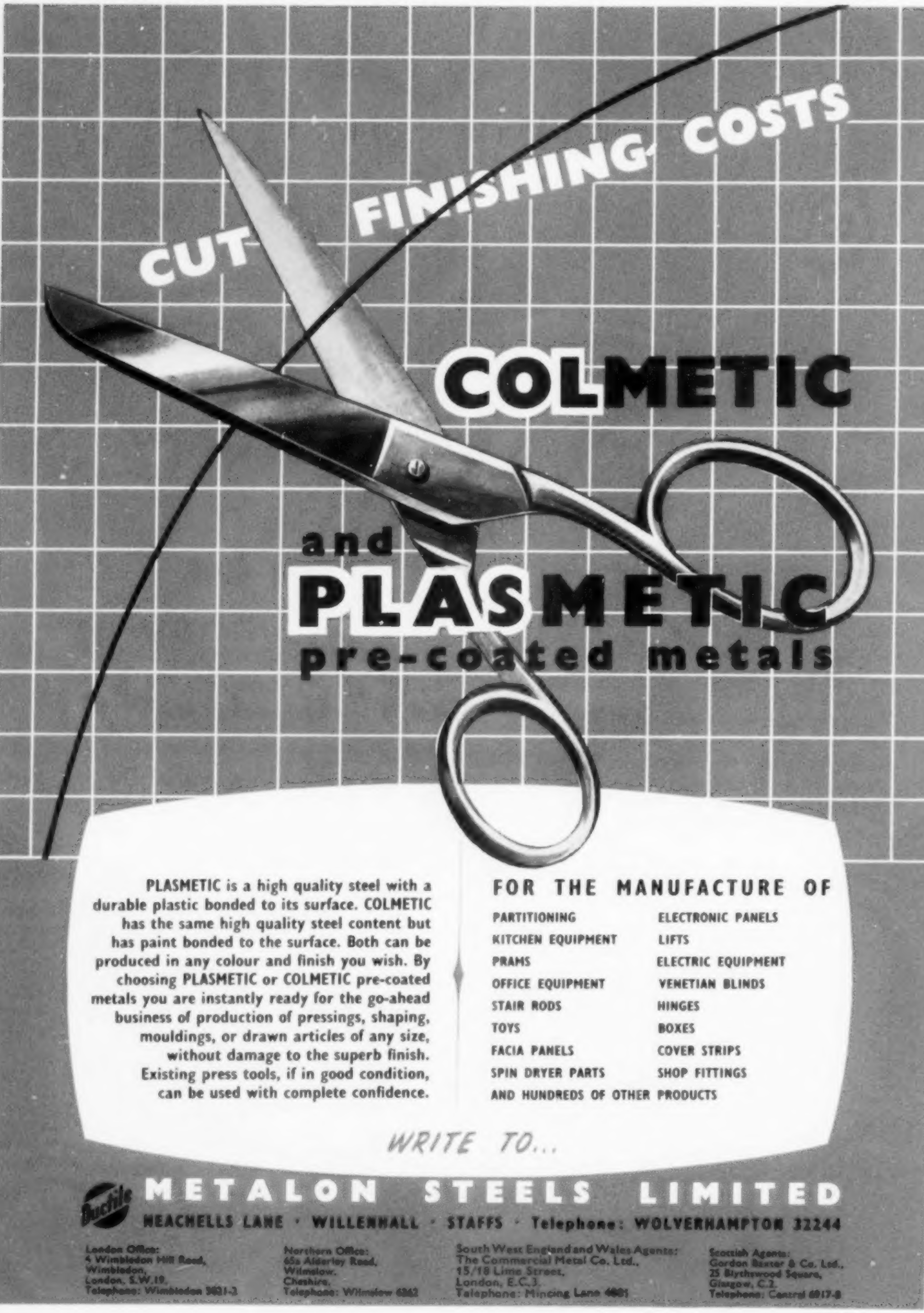
the strength of metal
married to the beauty and durability of PVC

The Hanovia Turboflo, shown above, is a typical example of the use made in the newest and most advanced designs of the latest metal finishing materials—vinyl plastic bonded to steel or aluminium. Named Plasteel and Plasminium, these new materials can be formed and deep drawn as easily as the basic metal and produce a finished article straight from the tools—saving the time and floor space taken for less modern finishing methods. In a basic range of attractive colours and designs, the plastic coating is also available in textured finishes such as wood and leather, and even in tartan effects. Plasteel and Plasminium are supplied in coils or flattened lengths ranging from $\frac{1}{2}''$ to $18''$ in width with metal thicknesses from 30 s.w.g. to 18 s.w.g. Write for full details and samples of new Plasteel and Plasminium.

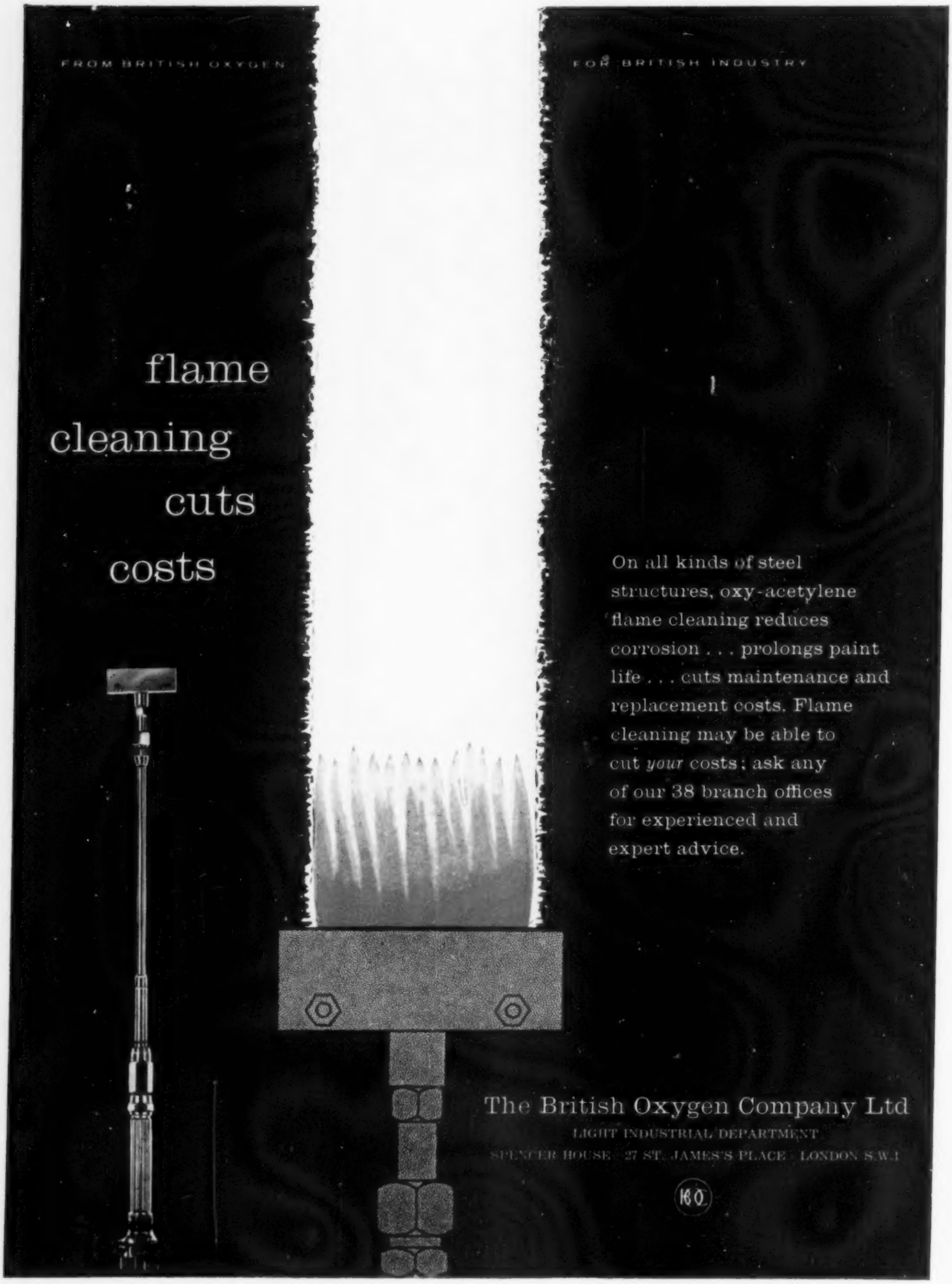
PLASMINIUM
PLASTEEL

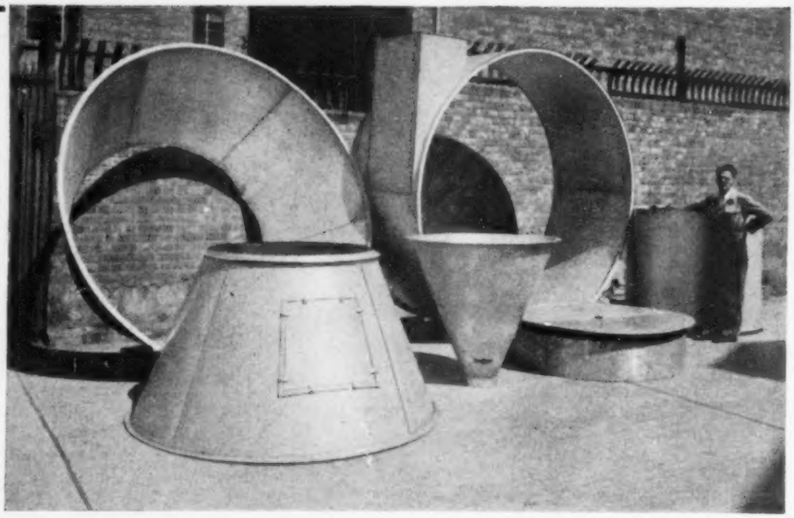
WILLMOTT TAYLOR LIMITED
Wharfdale Rd., Birmingham 11 Tel: Acocks Green 1186-7
London Agent: Samuel Mercer & Co. Eldon Street, E.C.2
Tel: Bishopsgate 5651


production
problem ?
automation
can be
the answer
Simpson
AUTOMATION DIVISION
lead
in
automation
design
Special purpose machines designed
and built to increase your productive
capacity and/or reduce labour costs.
Specialists in press shop
automation.
J. SIMPSON & SON (ENGINEERS) LTD.
MORETON WORKS,
ROUND GREEN,
LUTON,
BEDS.
Telephone: LUTON 5851/2



CUT FINISHING COSTS
COLMETIC
and
PLASMETIC
pre-coated metals
PLASMETIC is a high quality steel with a durable plastic bonded to its surface. COLMETIC has the same high quality steel content but has paint bonded to the surface. Both can be produced in any colour and finish you wish. By choosing PLASMETIC or COLMETIC pre-coated metals you are instantly ready for the go-ahead business of production of pressings, shaping, mouldings, or drawn articles of any size, without damage to the superb finish. Existing press tools, if in good condition, can be used with complete confidence.
FOR THE MANUFACTURE OF
PARTITIONING
KITCHEN EQUIPMENT
PRAMS
OFFICE EQUIPMENT
STAIR RODS
TOYS
FACIA PANELS
SPIN DRYER PARTS
ELECTRONIC PANELS
LIFTS
ELECTRIC EQUIPMENT
VENETIAN BLINDS
HINGES
BOXES
COVER STRIPS
SHOP FITTINGS
AND HUNDREDS OF OTHER PRODUCTS
WRITE TO...
Ductile
METALON STEELS LIMITED
HEACHELLS LANE · WILLENHALL · STAFFS · Telephone: WOLVERHAMPTON 32244
London Office: 4 Wimbledon Hill Road, Wimbledon, London, S.W.19. Telephone: Wimbledon 5821-3
Northern Office: 65a Alderley Road, Wilmslow, Cheshire. Telephone: Wilmslow 6262
South West England and Wales Agents: The Commercial Metal Co. Ltd., 15/18 Lime Street, London, E.C.3. Telephone: Mincing Lane
Scottish Agents: Gordon Baxter & Co. Ltd., 25 Blythswood Square, Glasgow, C.2. Telephone: Central 6917-8


FROM BRITISH OXYGEN
FOR BRITISH INDUSTRY
flame cleaning cuts costs
On all kinds of steel structures, oxy-acetylene flame cleaning reduces corrosion . . . prolongs paint life . . . cuts maintenance and replacement costs. Flame cleaning may be able to cut *your* costs; ask any of our 38 branch offices for experienced and expert advice.
The British Oxygen Company Ltd
LIGHT INDUSTRIAL DEPARTMENT
SPENCER HOUSE · 27 ST. JAMES'S PLACE · LONDON S.W.1



WE SHINE AT

SHEET METAL WORK!

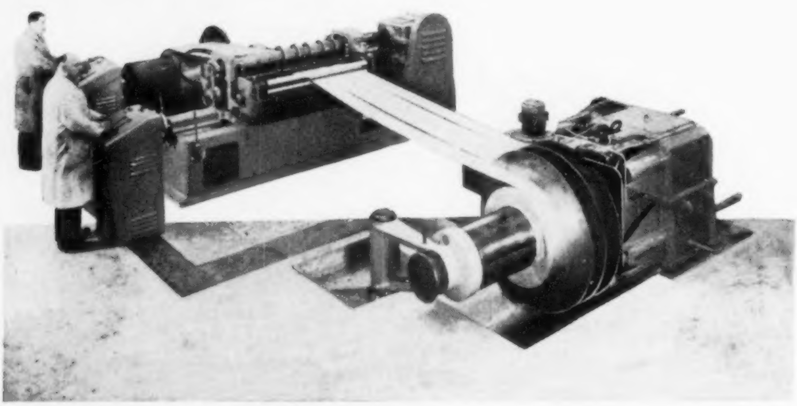
In meeting our customers' needs we produce an amazing variety of items. Some of the sizes and designs have to be seen to be believed. Whatever your problems in sheet metal we can solve them. We undertake work of all descriptions in light sheet metal up to $\frac{1}{4}$ in., light fabrications in sheet metal angle iron, etc., and tubular metal work in material up to 2 in. diameter.

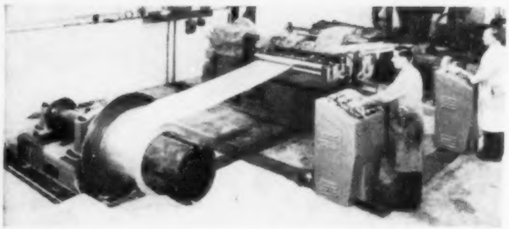
C·W·S

BIRTLEY TINPLATE WORKS

★ *We shall be happy to receive your enquiries*

C.W.S LTD., BIRTLEY, Co. DURHAM



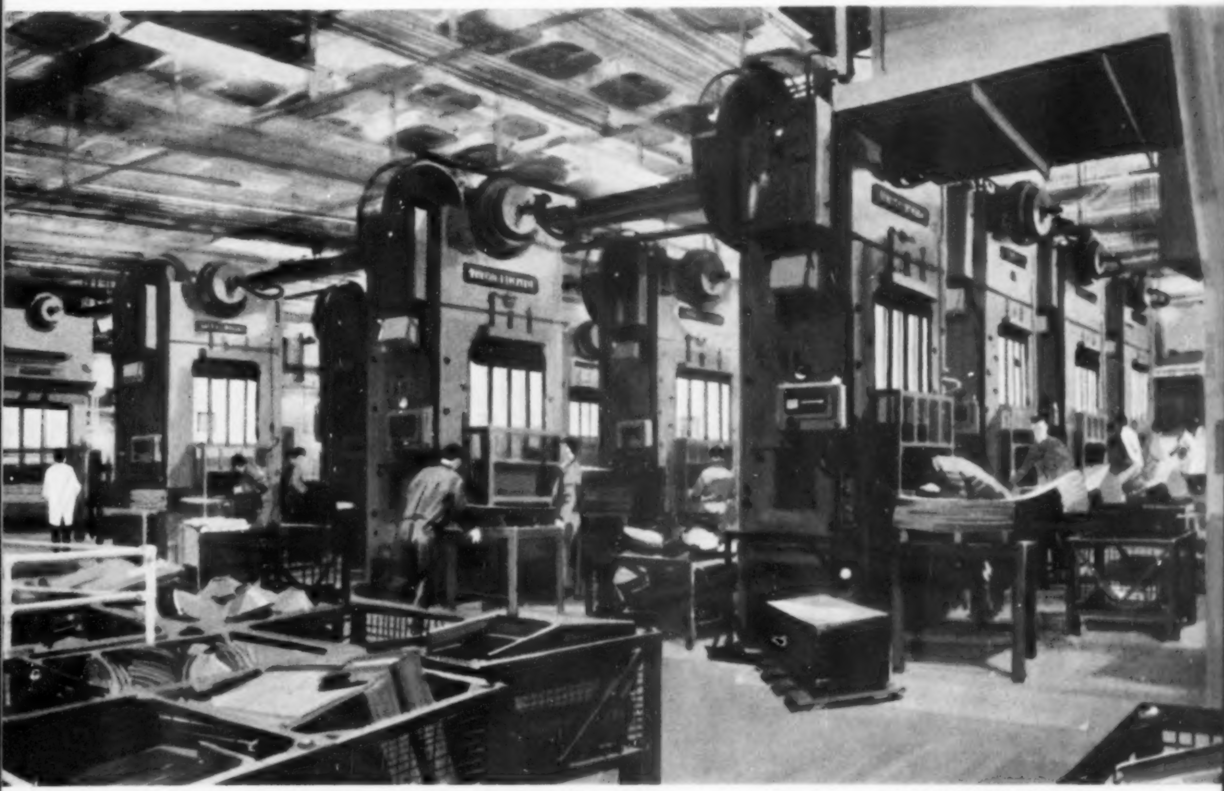


PRESSING FOR PRODUCTION . . .

The pressing assembly as produced by HOOVER Ltd for their KEYMATIC Washing Machine in their Merthyr Tydfil Press Shop illustrated on the opposite page.

... THE APPLIANCE FIELD

The preference of so many of the busiest manufacturers in the appliance industries for Wilkins & Mitchell Power Presses, especially in their most recent installations, is based on their need for higher productivity. Throughout the world, users have learned to rely on the design, dependability and built-in reserves of Wilkins & Mitchell Presses .. the complete press shop .. or the single press. Why not consult us on your press requirements?



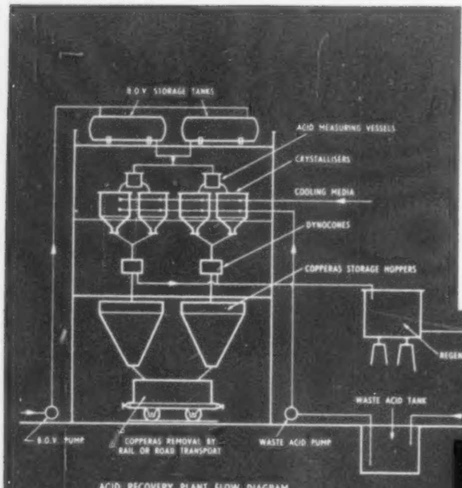
WILKINS & MITCHELL PRESSES (150 to 350 tons—36" to 108" between uprights) at work on HOOVERS latest washers.

WILKINS & MITCHELL

The Presses that cut costs

WILKINS & MITCHELL LTD . DARLASTON . S. STAFFS . ENGLAND

612 Cogent



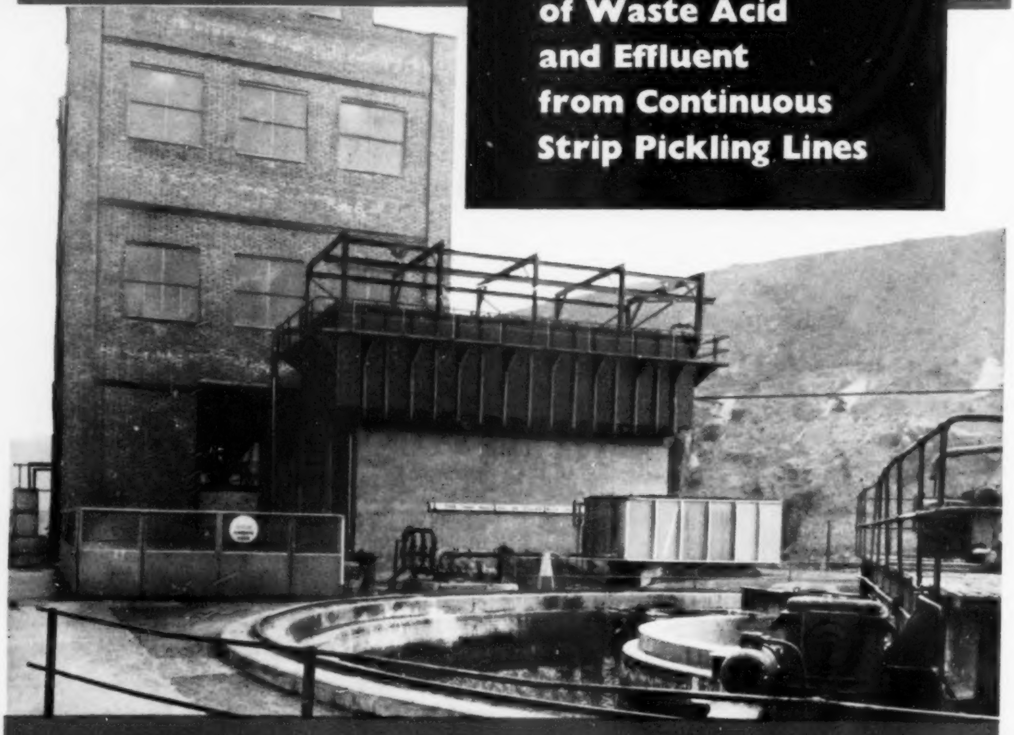
ACID RECOVERY PLANT FLOW DIAGRAM

The sulphuric acid regeneration plant recently installed by John Thompson (Dudley) Ltd., at the new Brinsworth Mill of Steel, Peech & Tozer, is probably the largest of its kind in this country. The complete plant is capable of treating all spent pickle liquors from the continuous strip lines in the mill, and provision has been made for doubling the capacity of this plant at a future date to meet the demand when the mill is working at maximum capacity.

In addition to the above there is installed a large neutralisation plant for dealing with all waste effluents from the continuous strip lines. These plants are larger than any likely to be required in the wire industry, but the same principles are applicable to plants on a smaller scale and of smaller capacity, which would be of considerable interest and value to the medium and large wire mill using sulphuric acid.

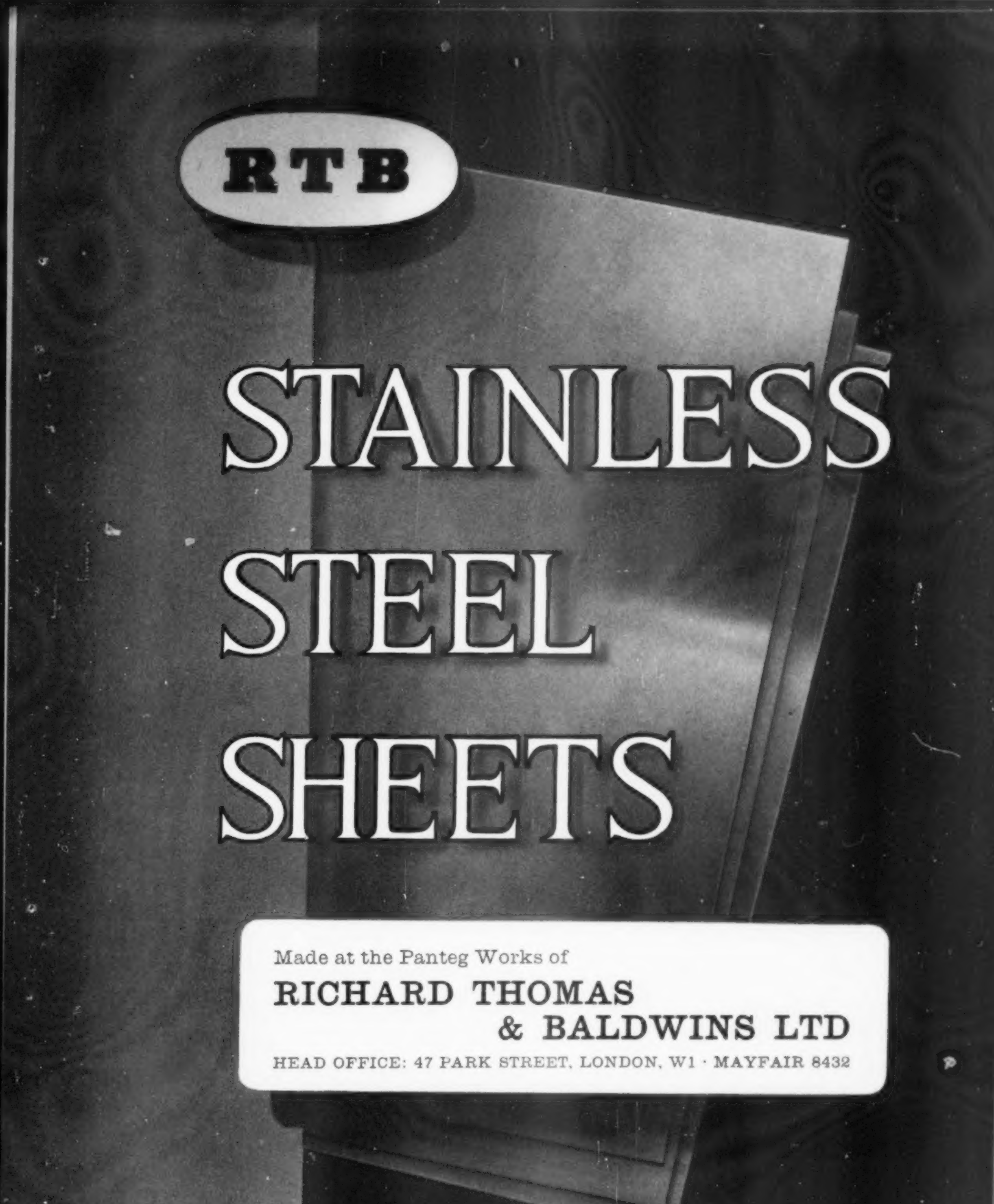
JOHN THOMPSON (DUDLEY) LIMITED
JOHN THOMPSON GROUP

Treatment of Waste Acid and Effluent from Continuous Strip Pickling Lines



JOHN THOMPSON (DUDLEY) LTD DUDLEY WORCS.

DA/3


RTB
STAINLESS
STEEL
SHEETS
Made at the Panteg Works of
RICHARD THOMAS
& BALDWINS LTD
HEAD OFFICE: 47 PARK STREET, LONDON, W1 · MAYFAIR 8432

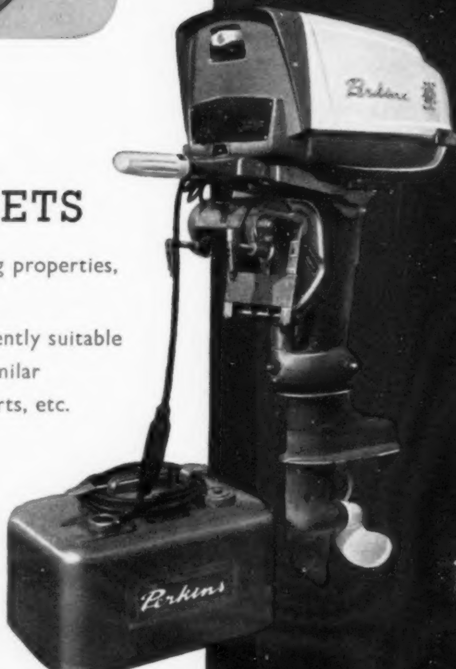
FUEL TANKS MADE FROM RTB TERNE-COATED SHEETS

RTB terne-coated sheets have excellent working properties, lending themselves to all fabricating processes.

Their resistance to corrosion makes them eminently suitable for petrol tanks, fire-extinguishers and other similar containers, and for ventilation ducting, radio parts, etc.

Further, they form an excellent basis for most industrial paints.

The illustrations show the neat fuel tank of the Perkins outboard motor. The clean lines obtained by the deep-pressing are made possible by the quality of the RTB steel which is the basis of the terne-coated sheets.



Richard Thomas & Baldwins (Sales) Ltd

47 PARK STREET, LONDON, W.1 *Telephone: Mayfair 8432*

RTB

AUGUST 1961
No. 412 Vol. 38

Sheet Metal Industries

incorporating
PRESS TOOL ENGINEERING

Editor:
EDWARD LLOYD, A.I.M., A.C.T.(Birm.)

Assistant Editor: TREVOR EVANS
Commercial Editor: F. H. HARLEY
Editorial Assistant: DOROTHY CLEAL
Production Manager: R. J. LOVELL
Circulation Manager: E. T. GRIFFITHS
Publishing Manager: H. J. DWYER

Advertisement Director: GEO. WESTON

AN INDUSTRIAL NEWSPAPERS PUBLICATION

Published by
INDUSTRIAL NEWSPAPERS (FUEL AND METALLURGICAL) LTD.

Directors:
F. BARRINGTON HOOPER, B.A., *Managing Director*
F. H. HARLEY JOHN HOOPER V. C. FAULKNER
E. G. WESTON, *Secretary*

JOHN ADAM HOUSE, 17-19 JOHN ADAM STREET
ADELPHI, LONDON, W.C.2
Phone: TRAfalgar 6171 (P.B.X.) *Grams:* "Zacatecas, Rand, London"

Subscription Terms: Home and Overseas 30/- per annum, prepayable. Single copies 2/6 plus postage

CONTENTS

Cut power loss and down time

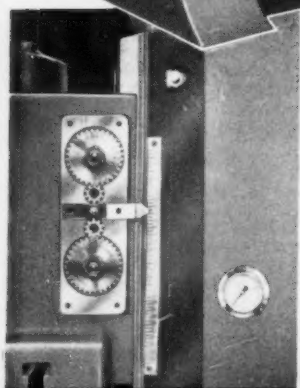
caused by
wear and wastage in
the friction drive

WEINGARTEN

PERCUSSION PRESSES

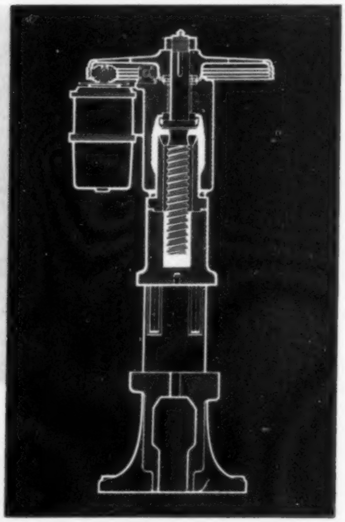
outdate *Friction Screw Presses! . . .*

for Embossing, Sizing
and Hot Working



Ram Stroke Adjustment
The strength of blow
is set to a calibrated
setting scale.

All the energy of
all the moving parts
is available for
the percussion blow.



PEARSON PANKE LTD

1-3 HALE GROVE GARDENS,
LONDON, N.W.7
Tel: Mill Hill 3232 Telex: 23273

NRP 5252

FOR OUR OVERSEAS READERS

RÉSUMÉS DES PRINCIPAUX ARTICLES

Procédés de fabrication dans les usines de Beacon de la John Thompson Motor Pressings Ltd.—7 .. page 558

Cet article qui termine la série d'articles sur la John Thompson Motor Pressings Ltd., décrit d'autres procédés de fabrication pour le soudage de pièces détachées à partir de matériaux de jauge plus épaisse. Presque toutes les opérations sont effectuées avec des presses normales, des guillotines et du matériel de soudage électrique.

Les articles fabriqués comportent la trémie Dumbo, servant à la manutention en vrac du ciment et d'autres poudres sèches. L'article décrit aussi un grand dispositif de transport des pièces, conçu pour le montage à bord d'un camion à conversion spéciale et comportant des vérins croisés pour élever ou abaisser la plateforme.

Moulage et laminage continus de l'aluminium page 565

Par H. W. Brand.

Cet article décrit deux chaînes de moulage et de laminage continus pour la fabrication en série de rubans d'aluminium. Les chaînes décrites se trouvent dans les usines de la Lips N.V., Drunen, Pays-Bas, et de la Extrusion Development Corp., Hawthorne, New Jersey, Etats-Unis. Le matériel utilisé a été étudié conjointement par les sociétés Aluminium Laboratories Ltd., et Albert Mann Engineering Ltd.; celle-ci fabrique aussi le matériel d'équipement dans son usine de Basildon. La chaîne américaine produit des rubans laminés à chaud dont on se sert comme lingots pour le refoulement au choc; la chaîne hollandaise comprend un laminoir à froid servant à la fabrication de rubans minces. Les deux chaînes se servent d'un fourneau de fusion Sklenar, et toutes deux comportent une cisaille volante.

Evolution et Etat Actuel des Installations de Fabrication des organes Forgés à Froid page 573

Par le Dr. -Ing. H. D. Feldmann.

La description de l'outillage à forger à froid, construit par Cold Forging Ltd. représente le sujet principal de ce mémoir, le dernier qui ait été présenté à la conférence spéciale au sujet du "Refoulage à Froid de l'Acier", organisée par l'Institute of Sheet Metal Engineering (Institut des Ingénieurs-Tôliers).

(Suite page 605)

ZUSAMMENFASSUNGEN DER HAUPTARTIKEL

Produktionsverfahren im Werk Beacon der John Thompson Motor Pressings Ltd. — 7 .. .. Seite 558

Dieser Schlussartikel der Serie über die John Thompson Motor Pressings Ltd. beshcreibt weitere Fertigungsverfahren zur Herstellung von Teilen aus Material von verhältnismässig grosser Stärke. Fast alle Arbeitsgänge werden mit normalen Biegepressen, Blechscheren und elektrischem Schweissgerät ausgeführt.

Unter den hergestellten Erzeugnissen ist der Dumbo-Muldenwagen zur Bedförderung von losem Zement und anderer trockener Pulver. Weiter wird eine grosse Pritsche für einen speziell umgebauten Lastwagen mit eingebauten Scherenwinden zum Heben und Senken der Plattform beschrieben.

Kontinuierliches Giessen und Walzen von Aluminium Seite 565

Von H. W. Brand.

Der Artikel beschreibt zwei kontinuierliche Guss- und Walzstrassen zur Herstellung von Aluminiumband. Sie befinden sich in den Werken der Lips N.V., Drunen, Holland bezw. der Extrusion Development Corp., Hawthorne, New Jersey, U.S.A. Die Anlagen wurden von der Aluminium Laboratories Ltd. in Zusammenarbeit mit der Albert Mann Engineering Ltd. entworfen, der Bau erfolgte im Werk Basildon der letzteren Firma. Die amerikanische Strasse erzeugt warmgewalztes Band, das als Rohling für das Kaltspritzen benutzt wird; die holländische enthält ein Kaltwalzwerk zur Herstellung von dünnen Streifen. Beide Strassen verwenden einen Sklenar Schmelzofen und eine fliegende Schere.

Entwicklung und gegenwärtiger Stand der Einrichtungen zur Erzeugung kaltgeschmiedeter Gegenstände Seite 573

Von Dr. -Ing. H. D. Feldmann.

Der Hauptgegenstand dieser Abhandlung ist die Beschreibung der Einrichtungen für Kaltschmiedearbeiten, erzeugt von Cold Forging Ltd., welche die letzte Abhandlung der Sonderkonferenz „Das Kaltpressen von Stahl", vom Institut der Blechverarbeitenden Industrie.

(Forts. S. 605)

RÉSUMENES DE LOS ARTICULOS PRINCIPALES

Procedimientos de producción en los Talleres Beacon de la John Thompson Motor Pressings Ltd. - 7 página 558

Este articulo, el último de la serie sobre la John Thompson Motor Pressings Ltd., describe algunos otros procedimientos de fabricación empleados en la producción de elementos con materiales de calibre más grueso. Casi todas las operaciones se llevan a cabo con prensas normales, guillotinas y equipo de soldadura eléctrica.

Entre los articulos que se producen se encuentra la tolva Dumbo, destinada al manipuleo de cemento y otros polvos secos a granel. También se describe estanteria montada sobre camión, concebida para ser llevada sobre un camión especialmente adaptado con gatos de tijera integrales para alzar y bajar la plataforma.

Fundición y laminación continuas de aluminio página 565

Por H. W. Brand.

Este articulo describe dos cadenas continuas de fundición y laminación para la producción de fleje de aluminio. Las cadenas descritas se hallan en los Talleres de Lips N.V., Drunen, Holanda y en los de la Extrusion Development Corp., Hawthorne, New Jersey, EE. UU. de A. El equipo empleado fué creado en colaboración por la Aluminium Laboratories Ltd. y la Albert Mann Engineering Ltd. que también construye el equipo en sus Talleres de Basildon, Inglaterra. La cadena americana produce fleje laminado en caliente que se emplea como materia prima para extrusión por impacto y la cadena holandesa comprende un laminador en frío para la producción de fleje fino. Ambas cadenas emplean un horno de fundición Sklenar y una cizalla volante.

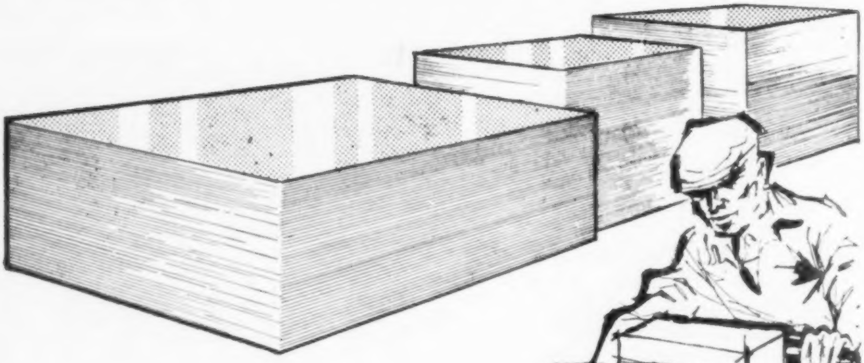
Perfeccionamiento y situación actual de las instalaciones para la fabricación de elementos forjados en frío página 573

Por el Dr.-Ing. H. D. Feldmann.

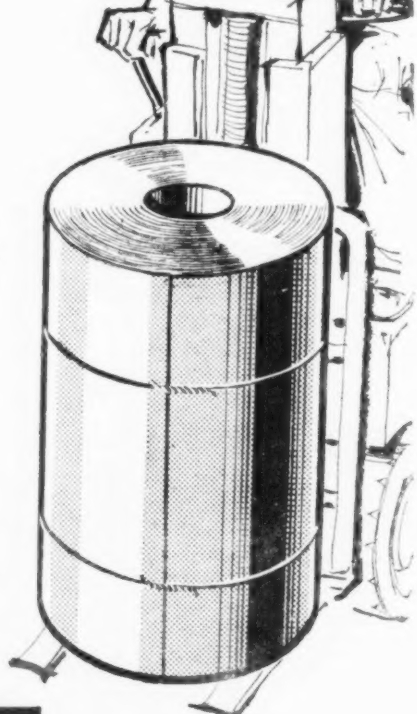
Una descripción del equipo para forjar en frío fabricado por la Cold Forging Ltd. constituye el tema principal de esta ponencia, que fué la última presentada durante la conferencia especial sobre "Extrusión en frío del acero" organizada por el Instituto de la Ingeniaria de la Chapa Metálica.

(Continuara en p. 605)

Do you use sheet . . .



. . . and strip?



Do you need it to be light yet strong, easy to fabricate yet rugged? Do you need it to have excellent resistance to corrosion? Then what you need is Birmabright.
Birmabright Limited also manufacture plate, extruded sections, rod and bar, wire, tube and forgings in aluminium/magnesium alloy.

Birmabright
Registered Trade Mark

Birmabright Limited

WOODGATE WORKS · BIRMINGHAM 32

BM 287

Sheet Metal Industries

Incorporating PRESS TOOL ENGINEERING

Official Organ of the following Associations:

INSTITUTE OF SHEET METAL ENGINEERING

President: Mr. E. W. HANCOCK, O.B.E. *Chairman:* Mr. A. E. GILBERT

Hon. Secretary: Mr. JOHN HOOPER, John Adam House, 17-19 John Adam St., Adelphi, London, W.C.2. Tel.: TRAfalgar 6171 (P.B.X.)

SHEET METAL INDUSTRIES ASSN. LTD.

Chairman: Mr. H. R. TROST

Secretary: Mr. A. E. WARD, F.C.I.S., 68 Gloucester Place, London, W.1. Tel.: HUNter 1945.

STAINLESS STEEL FABRICATORS' ASSN.

Chairman: Mr. K. LIVERSIDGE.

Secretary: Mr. F. J. WINFIELD, Chamber of Commerce, P.O. Box 360, 75 Harborne Rd., Edgbaston, Birmingham, 15. Tel.: EDGbaston 6171

BRITISH POWER PRESS MANUFACTURERS' ASSN.

Chairman: Mr. H. D. CHALLEN

Secretary: Mr. G. T. BEACH, Standbrook House, Old Bond Street, London, W.1. Tel.: HYDe Park 3451.

COLD ROLLED SECTIONS ASSN.

Chairman: Mr. D. L. BATES

Secretaries: FRANK IMPEY & Co., Lombard House, 144 Great Charles Street, Birmingham, 3. Tel.: CENtral 2073.

COLD ROLLED STEEL STRIP ASSN.

Chairman: Mr. L. G. FIRTH

Secretary: Mr. R. T. TARRANT, Steel House, Tothill Street, London, S.W.1. Tel.: WHItehall 1030.

A PLEASANT CHANGE

MUCH has been written, re-written, spoken and discussed by government officials, members of Parliament and by the press and many others about the technological progress of this country as compared with, for example, the U.S.A. and the U.S.S.R. Events that have taken place in these two latter countries in the last few years have, in fact, tended to overshadow other technological advances in all countries, and the recent visit of Russia's first " space man," Yuri Gagarin, and his reception here, only serves to highlight the trend of the public's thoughts, which are now channelled into the space age.

And yet in spite of space research which nowadays " hogs " too many columns in too many publications, technological progress in other spheres continues, we are glad to say. But so many discoveries from this country are developed to a commercial basis elsewhere that it is, therefore, satisfying to us to be able to report a reversal of what has become to be accepted as the general order of things.

From the inception of the smelting of metals it has always been the aim to eliminate many of the costly intermediate processes required to produce sheet (and other products) and in the steel industry the ultimate goal is undoubtedly to produce steel direct from the basic raw materials and to process this direct into sheet. Some progress has already been made in this direction, and the work is continuing, and no doubt the production of steel sheet and strip direct from molten steel will be in commercial production in the not too distant future.

In the non-ferrous industry much more progress has been made, and elsewhere in this issue we describe two continuous casting and rolling installations for aluminium, one in the U.S.A. and the other in Holland. The important point about these is that the equipment was designed and built by a British firm, who have steadily persevered for many years to bring the commercial use of this type of plant to fruition. Another important point is that the company concerned cannot be called " large " in the accepted sense of the word, and the development of this and other specialized equipment, such as the completely enclosed rolling mills with remote-controlled roll changing for nuclear materials reported in an earlier issue of this Journal, must have involved a great expenditure of capital.

However, in spite of the difficulties involved in projects of this type, the company are able to market their products at extremely competitive prices. Although the company have an agreement with a large American rolling-mill manufacturer to build mills in this country, we can also record the fact that the British company have designed mills that are now being built in the U.S.A.

There is surely a moral in this story which ought to be obvious, and although today it is unfashionable in many spheres to be " British minded " it gives us pleasure to report the achievements of this British company. What a pleasant change!

Production Procedures at the Beacon Works of JOHN THOMPSON MOTOR PRESSINGS Ltd.

Heavy Industrial Fabrications

LAST month, the series described some of the procedures used at John Thompson Motor Pressings in the manufacture of items in heavier gauge materials for the commercial vehicle and railway trades. In addition to these specialized fields there is still a great deal of heavy-gauge fabrication undertaken for the strictly "non-mobile" industries.

Nearly all the fabricating operations are carried out with normal press brakes, guillotines, and electric welding equipment, but the degree of skill with which these relatively simple pieces of equipment are operated enables many complicated shapes to be manufactured to a very high degree of accuracy.

Dumbo Hoppers

Among the metal fabrications undertaken for the building industry is the Dumbo hopper, built by John Thompsons for Abelson & Co. for handling cement and other dry powders in bulk. The hopper is constructed in mild steel and is made in 10, 20 and 40-ton models. A feature of these units is that they are only just top heavy, and skids are fixed to the bottom with rounded bearers at the bottom of the cylindrical section. A winch unit is built in at the bottom of the hopper and by means of a system of pulleys the hopper can be toppled on to the back of a lorry by one man, the bearers rolling the hopper on to the lorry platform. Erection of the hopper on site is accomplished with the same ease, the hopper rolling on the bearings into an upright position. A 40-ton model is also made but without the one-man handling qualities of the smaller models.

Most of these hoppers are used on building sites throughout the country, but a few are employed for storing grain. The rubber sealing at the top of the cylindrical section with a wire mesh breather ring makes them ideal for dry powders and grain. The rubber sealer has a fairly thick skin on the inside which prevents moisture entering and also prevents powder getting out. The sealing is arranged so that in the event of there being any pressure build-up inside the cylinder above 6 lb. per sq. in., it ceases to be effective.

At the bottom of the hopper, directly below the cone section, is housed a device which weighs quantities of the contents automatically or manually.

Fig. 1.—An example of a diesel dumper with ½-in. plate pressed-steel body designed to reduce the dead-weight even further and increase the comparative strength. The capacity of this dumper is between 5 and 7 cu. yd.

7

(Series concluded from page 514, July, 1961)

The balance mechanism can be arranged to trip the shutter and cut off the flow into the skip when the preset weight has entered the skip. The skip can then be rotated in a horizontal direction away from the hopper for emptying. When pushed back under the mouth of the cone, the shutter is again automatically tripped open.

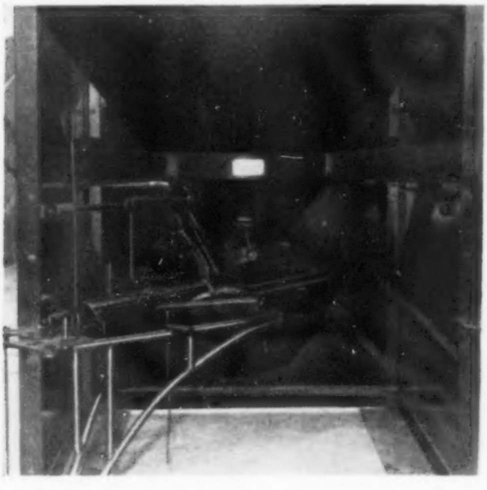
Fig. 2 (above and below).—General view of the Dumbo hopper showing clearly the skids on the bottom and the bearers, for rolling the hopper on to the back of the lorry. The winch mechanism can be seen at the bottom right

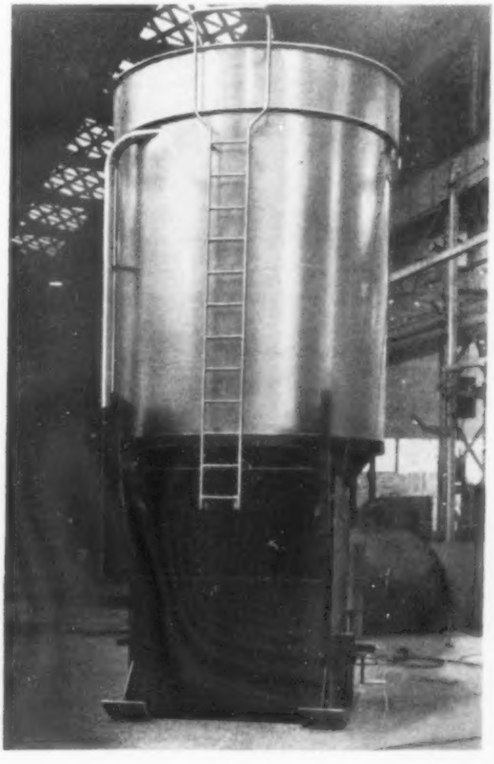
Fig. 3 (below left).—Weighing device which can be operated manually or automatically

Stillages

Another interesting piece of equipment which John Thompson's have undertaken to manufacture for a variety of possible applications is a large lorry-borne stillage. The stillage is designed to be carried by a specially converted lorry and has four legs which can be folded up. The lorry has scissor jacks built in to raise and lower the platform. Some of the stillages are made completely enclosed.

The method of using the stillage is simple and effective. The lorry drives with the stillage on the





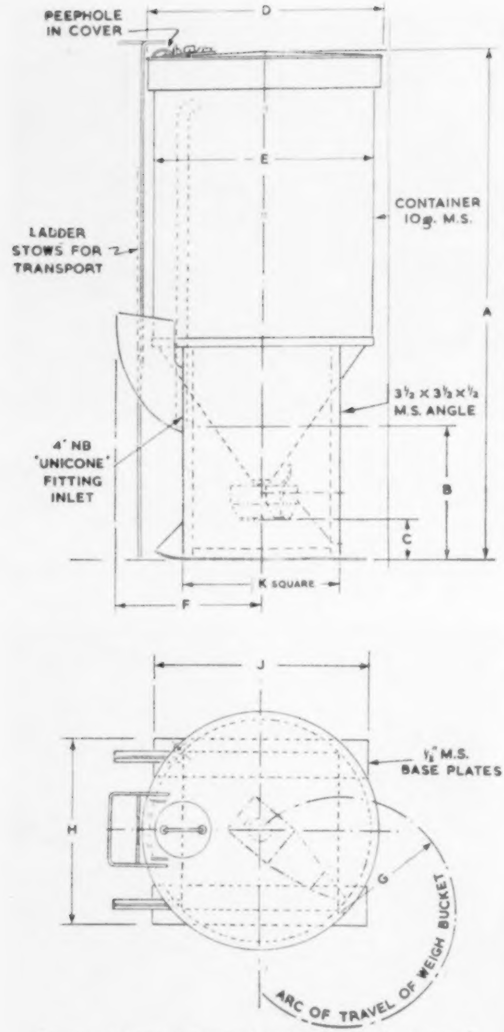


Fig. 4.—(above) Layout of typical Dumbo hopper and (below) typical dimensions.

Dimension	20-ton capacity
A	18 ft. 1 in.
B	4 ft. 0 in.
C	1 ft. 4 in.
D	8 ft. 3 in.
E	7 ft. 9 in.
F	5 ft. 2 in.
G	4 ft. 0 in.
H	6 ft. 5 in.
J	7 ft. 6 in.
K	5 ft. 6 in.

capacity of dispensers up to 260 lb.
20-*ton capacity model*—37½ *cwt.*

back with the legs folded up. The platform is raised by means of the jacks until the legs of the stillage in the down position clear the ground; the platform is then lowered until the stillage is standing on its own, and the lorry drives away from underneath. Collection of the stillage is in the reverse order.

Many airport authorities are using them as storage parts around airfields, and the possibilities of putting them to similar use on farms is being investigated.

The Dumbo hoppers and stillages form only a small part of the total work undertaken in this shop and are the only items that assume anything like production-line proportions. Repetition work for contractors plant is undertaken and includes dumper bodies, concrete pouring skips, and scoops for earth-moving equipment of innumerable shapes and sizes.

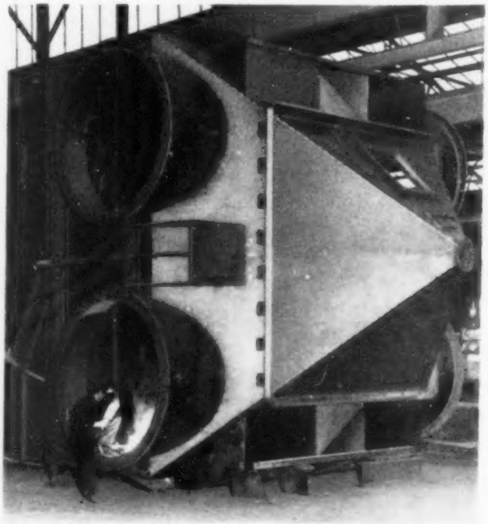
The bulk of the work undertaken is mainly highly accurate one-off jobs, its chief product being ducting for boiler plants and power-stations, and this can be fabricated at the rate of some 200 tons per month.

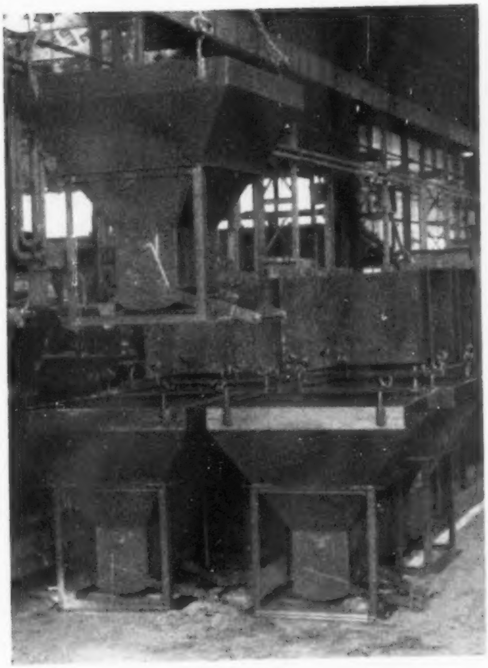
General Practice

Very little, if any, of the work undertaken in the construction department involves the use of press tools. The design of the items produced and the dimensions of the material used enable straightforward cutting, shearing and drilling methods to be employed.

The majority of the thicker plate is first rough-cut

Fig. 5.—Part of a sinter flue ducting, typical of some of the heavier fabricated ducting work carried out by the constructional department





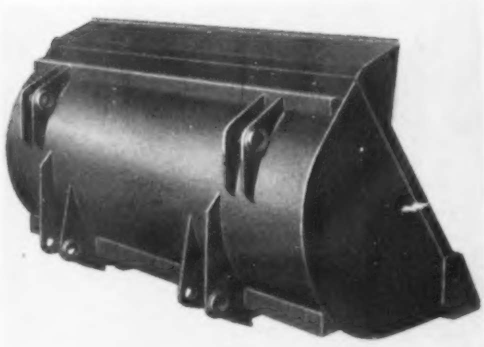


Fig. 7 (above).—One of the many scoops for earth-moving equipment. Holes in the upper face are provided for fixing metal "teeth" as required

Fig. 6 (above).—Concrete pouring skips awaiting delivery. The skips are manufactured in four sections with the top lip and shute at bottom formed in a press brake. The four sides are then electric-welded at the seams

Fig. 8 (above).—Scoop fitted to motorized unit engaged on moving granite chips on site. The scoops are manufactured with attachment brackets placed to suit type of unit used

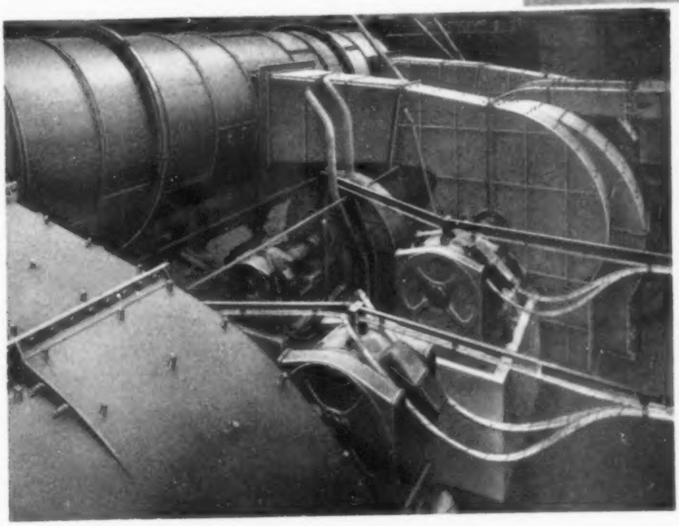


Fig. 9 (left).—Example of ducting and sectioned pipe-work installed. Pipe-work is built up from rolled sections and the ducting constructed from suitably shaped metal plate, the edges of which are rolled or formed on a press brake to the correct contour, and welded, or bolted according to the degree of sealing required

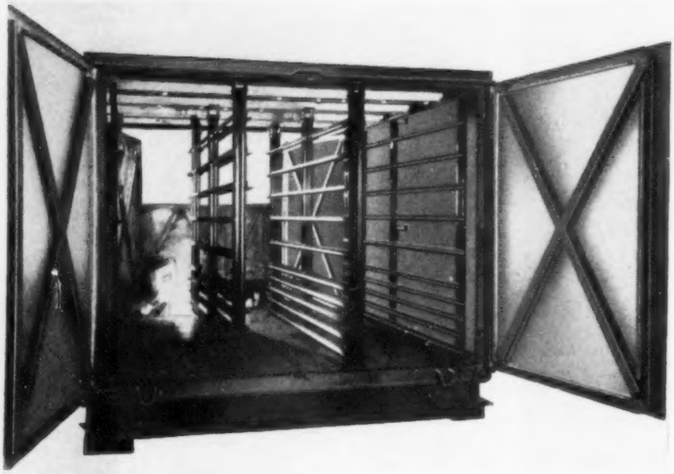


Fig. 10.—Some of the lorry-borne stillage are manufactured with an enclosed compartment and are suitable for storage irrespective of the clemency of the weather. Four legs are situated one at each corner and arranged so that they can be folded up when the stillage is being conveyed on the lorry. The floor of the stillage is made of either metal checker plate or wood

by hand oxyacetylene cutters, the shape being taken from templates, after which preliminary drilling operations are effected. Where there is more than one-off the cut sheets are drilled from templates up to eight at a time by radial arm drills. The one-off items are, of course, first marked up. Following the drilling, the cut plates are sheared to exact design dimensions in a De Bergue mechanical shear which takes the thicker plate up to ½ in., or in a Pearson hydraulic shear which shears up to ⅜ in. The Pearson shear is ideal for this type of work as it can be inched over the whole of the stroke.

The plates are then taken to the marking out section, where the high standard of work plays a very important part in the accuracy of the finished item. Typical marking-out operations include lines for bending the cone sections of Dumbo hoppers, and also ducting bends and sinter flue duct contours.

From these lines, marked in chalk on the plate, the press-brake operators are able to form the total contour with one blow at each line. The contour is checked at each blow with a template.

All the welding done in the shop is electric hand welding.

Dumbo and Stillage Manufacture

The main cylinder section of the hopper is made

Fig. 11.—The popularity of palletized storage necessitates the manufacture of pallets of many shapes and sizes to cover the infinite number of storage possibilities. The pallets shown have pressed-steel top surfaces and welded-section supports and stiffeners

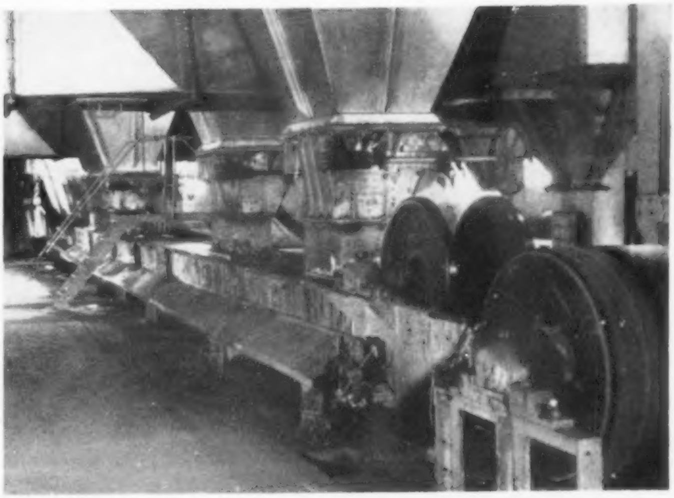


Fig. 12.—Machining and fabrication is also undertaken for the production of submerged ash conveyors. The tanks are cast in the company's foundry and machined and constructed in part of the heavy construction shop

from $\frac{1}{8}$ in. mild-steel sheet in four half-round sections. The flat plate is first cut up and rolled to the correct contour and welded together, the vertical seams being 90 deg. apart. The bottom cone is also made in four sections, but in this instance the contour is effected by press brake. Some variation in plate thickness is employed, depending on the hopper capacity, from $\frac{1}{8}$ in. to $\frac{3}{16}$ in.

The top of the hopper is made in 12 almost triangular segments with pressed side flanges. The segments are assembled first in a rough jig and electric welded along the seams. As an extra precaution against the ingress of dirt and corrosion, the seam of each segment is filled with a plastic cement which eventually sets hard. One segment has a general access hole cut into it, the cover plate of which is fitted with a safety valve which blows should the pressure build up of the interior exceed 4 lb. per sq. in.

The manufacture of the stillage is relatively straightforward, there being no unusual contours. The legs are made of square-sectioned tube rigidly braced to the main frame. The main frame is also made from pressed channel, also effected by press brake and vee block. Both the lorry platform and stillage platform are covered with steel checker plate, although some stillages have a wooden platform.

Some of the stillages destined for airfield work have an aluminium built body which extends to within 3 ft. of the rear end of the stillage platform. This enables the small uncovered section to be run into an aircraft when loading or unloading from the stillage.

Research Facilities

Brief mention was made in the opening instalment of the series of the research facilities available within the company, but no conclusion to an article of this nature would be complete without mentioning the investments made for the future in both techniques and manpower.

The year 1956 saw the opening of a new Group research laboratory which increased the already extensive research facilities within the group.

Laboratories and experimental engineering departments are furnished with the latest equipment, and researches into heat transfer, fluid flow, combustion and metal fatigue, keep the companies abreast of the many changing techniques. Also situated in this new building is an enlarged Group welding department.

Data gathered from experimentation and research by welding research engineers was incorporated in the manufacture of parts for the Dounreay nuclear power station and later applied to equipment made for the Berkeley contract. Chemical laboratories too contribute to the general pool of information distributed by the parent John Thompson company to its associates.

A well-stocked library is available for research and design departments, for the 300 John Thompson apprentices, and for men receiving training under a number of John Thompson training schemes.

Acknowledgements

Grateful acknowledgement is expressed to Mr. Christopher Thompson, managing director of John Thompson Motor Pressings Ltd., for permission to publish this series of articles, and to Mr. G. H. Lawrence and many of his colleagues for their unfailing assistance in its preparation.

NEW LABORATORY FOR FURNACE RESEARCH

Improved Facilities

Opened by

A E I - BIRLEC

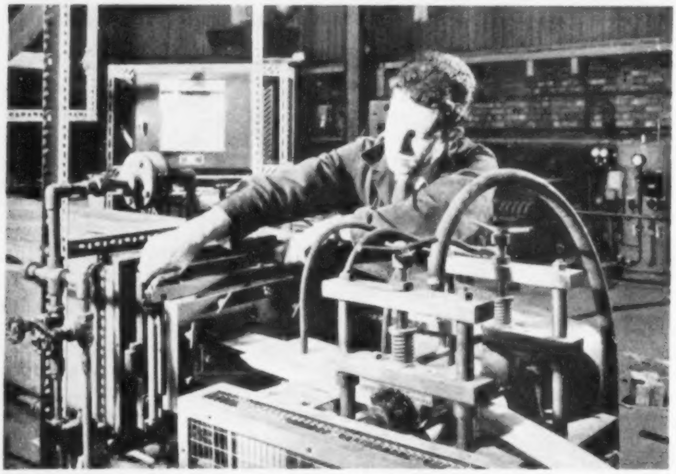


Fig. 1 (above).—General view of A.E.I.-BIRLEC research and development laboratory

Fig. 2 (left).—Adjusting atmosphere seals at the discharge end of the new stainless-steel-strip annealing furnace

THE Birlec research and development department came into being nearly 25 years ago, soon after the formation of the company. For the greater part of its existence it has been located at the company's main premises in Tyburn Road, Birmingham but in recognition of the growing importance and scope of its work, the department has been transferred to larger premises at Wood Lane. The new laboratory is housed in a building 275 ft. × 70 ft. which, including a balcony, provides a total floor area of 20,000 sq. ft. It is claimed that this is the largest and best equipped research and development department in the furnace industry.

The organization has four major sections dealing respectively with metallurgical processes, furnace design, gas plants and dryers and the testing of prototype equipment. A certain amount of work is also undertaken for an associate company, Birlec-Efco (Melting) Ltd., and the staff is responsible for operating a pilot smelting plant for this company near Aldridge.

Electric power up to a rating of 750-kVA is distributed throughout the department, as well as town's gas up to 9,000 cu. ft. per hr., mains water up to 4,000 gal. per hr., re-circulated cooling water up to 2,000 gal. per hr. and compressed air up to 18,000 cu. ft. per hr.

An overhead crane of 10-tons capacity with a 24-ft. lift serves the entire area.

Rooms are provided for the preparation of metallurgical specimens, microscope and photographic work. Instruments available include infrared gas analyzer, Hersch oxygen analyzer, Foxboro Dewpoint measuring and control units and a "moisture monitor" dewpoint instrument. A

(*Continued in page* 603)

CONTINUOUS CASTING AND ROLLING OF ALUMINIUM

Some Details of American and Dutch Installations
Designed and Built by Albert Mann Engineering Co. Ltd.

By H. W. BRAND

Introduction

WHEN Dr. Erhard Herrmann's "Handbook of Continuous Casting"* was published in 1959, probably many people connected with the aluminium industry thought the opinion expressed by Aluminium Ltd., Canada, as somewhat optimistic, that in the future, plants would be erected where at one end aluminium would be melted and at the other, extruded tubes and cans would be ejected. However, within one year a most important step in this direction was taken, when in the United States, the most modern continuous strip casting and rolling line for aluminium was commissioned, and then, shortly afterwards, Europe followed, with a slightly larger and more versatile line which went into operation in Holland in February, 1961.

It is surprising that these lines were not developed and built in the United States, but due to the continuous co-operation between Aluminium Laboratories Ltd. and Albert Mann Engineering Co. Ltd., Basildon, they were in fact developed in England.

When Aluminium Laboratories had completed their initial programme on the pilot plant, Albert Mann Engineering Co. Ltd., were asked to design a Mark II machine more suitable for general manufacture and shipment and this machine replaced the earlier machine in the pilot plant at Banbury and was operated for several years. The Mark II casting machine is described in detail in Dr. Erhard Herrmann's handbook of Continuous Casting on pages 531 and 532.

Although this machine produced good strip up to 12 in. wide continuously, various improvements were incorporated which proved of benefit from the metallurgical aspect and in 1960 the new Mark III Model was completed and was found to have overcome all the teething troubles of the previous models.

* Hermann, E., "Handbuch des Stranggießens," Düsseldorf, Aluminium-Verlag, GmbH, 1959.

In the meantime Albert Mann Engineering Co Ltd., had made such progress in two of their sections, namely, the rolling-mill division and the electronics division, that they were now ideally placed to build a fully continuous integrated casting and rolling line. As the design and manufacture of the complete line including the synchronized drives and their electronic controls could now be undertaken by one concern, the overall costs were kept down which meant that these integrated lines became available to users of narrow strip and in addition were even more interesting to the producers of large quantities of slugs. It is not surprising, therefore, that first the American line was installed for the production of collapsible tubes and aerosol cans, whereas the line installed in Holland was designed and built to supply the necessary strip to a tube forming mill.

This difference in the two lines (Table I) should be remembered when considering the following text. The American line has been designed especially for one end-product, that being slugs for the production of impact-extruded tubes and cans, whereas the Dutch line was installed to supply stock for (*a*) strip in various gauges and widths for the manufacture of welded tubes, (*b*) narrow strip in any gauge down to 0.010 in., (*c*) slugs for impact-extruded tubes, as a third alternative.

DESCRIPTION OF THE LINE

Casting Machine Mark III

The main difference between this casting machine and the two previous models as well as most of the other well-known types of rotary casting machines, is, that the casting wheel itself is not keyed onto the shaft, but rotates on a stationary shaft of such large diameter that deflexion is almost non-existent, the wheel being driven by a rim drive. This drive to the rim is taken through two worm reductions which can be set to obtain the minimum back-lash in this

TABLE I (*right*).—*Details of the Two Lines*

Item	American Line*	Dutch Line†
Furnaces	1 off—6,000 lb. per hour Sklenar furnace without holding furnace, gas fired.	1 off—6,000 lb. per hour Sklenar furnace without holding furnace, oil fired.
Casting machine	1 off—$\frac{3}{4}$ in. × 8 in., mean casting speed 15 ft. per min.	1 off—$\frac{3}{4}$ in. × 9 in. mean casting speed 15 ft. per, min.
Rolling mills	2 off—two-high hot-rolling mills in tandem, roll dimensions 12 in. × 12 in.	1 off—combined two-high hot- and cold-rolling mill. Roll dimensions 12 in. × 12 in. 2 off—four-high cold-finishing mills in tandem. Roll dimensions 5 in. × 12 in. × 12 in.
Flying shear	1 off—hydraulic.	1 off—hydraulic.
Coilers	2 off—20 in. drum diameter 46 in. coil o.d.	2 off—12 in. drum diameter 40 in. coil o.d. in the hot line. 1—20 in. drum diameter 40 in. coil o.d. in the cold tandem line.
Installed kW. Total	200 kW.	300 kW.

* This line was installed by Extrusion Development Corporation Ltd., Hawthorne, New Jersey, a subsidiary of White Metal Mfg.

† This line was installed by Lips N.V., Drunen, and the details are shown in Figs. 2 to 10.

part of the drive. The back-lash in the pinion and the internal gear of the rim drive can be taken up by adjusting an eccentric bush in the hub of the wheel itself. This design guarantees absolutely smooth running of the casting wheel completely eliminating any shudder or vibration at the periphery of the casting wheeldue to magnified torsion in the rotating shaft or to back-lash in the driving elements. The endless mild-steel belt which covers the mould groove in the circumference of the casting wheel is now led over four idling rollers instead of three on previous machines. This has the following advantages:—

1. Above and beneath the casting wheel the mild-steel belt runs horizontally which makes available more room for locating the tensioning arrangement (the belt is tensioned pneumatically) on the front pulley and stronger and more efficient outboard bearings could be adopted. Allowing the upper portion of the belt to run horizontally makes it possible to mount a pneumatic cylinder behind the top front pulley which applies constant pressure to this pulley and so pressing the mild-steel belt constantly onto the casting rim at the point where metal is poured into the wheel.

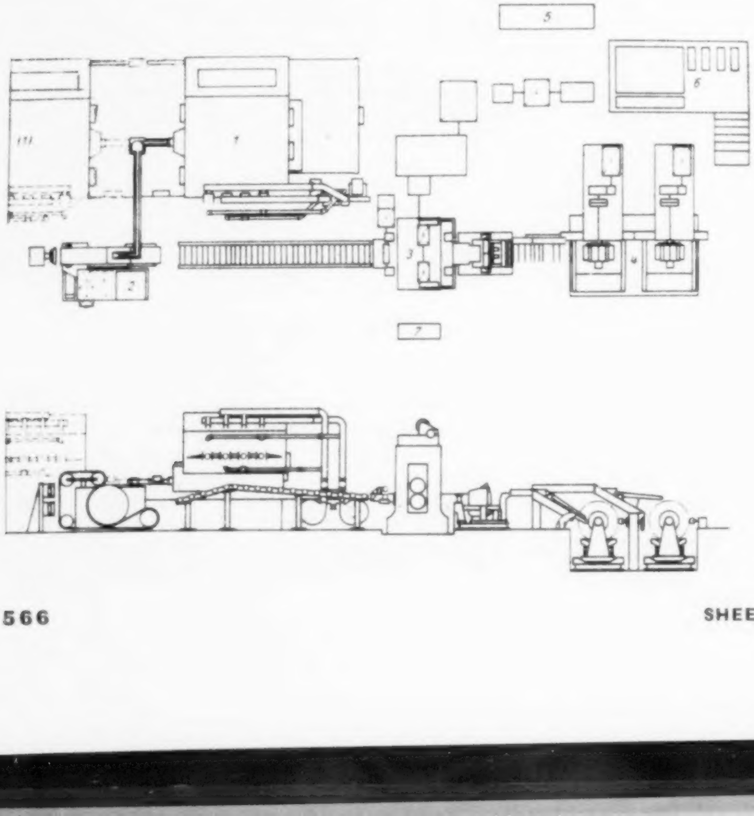


Fig. 1.—Schematic illustration of a strip casting and rolling installation for aluminium strip of 350 mm. width (total length of the installation 18.4 m., total width 8.6 m.). 1: Oil-heated Sklenar melting furnace (output 3,000 kg. per hr.). In a later stage of expansion two of these furnaces are provided. 2: Casting machine for strip of 19 mm. thickness and 350 mm. width. 3: 2-high hot-rolling mill (roll dimensions 400 × 450 mm.) with hydraulically operated flying shear. 4: Twin recoilers. 5: Switch pedestal. 6: Pumping station. 7: Control desk

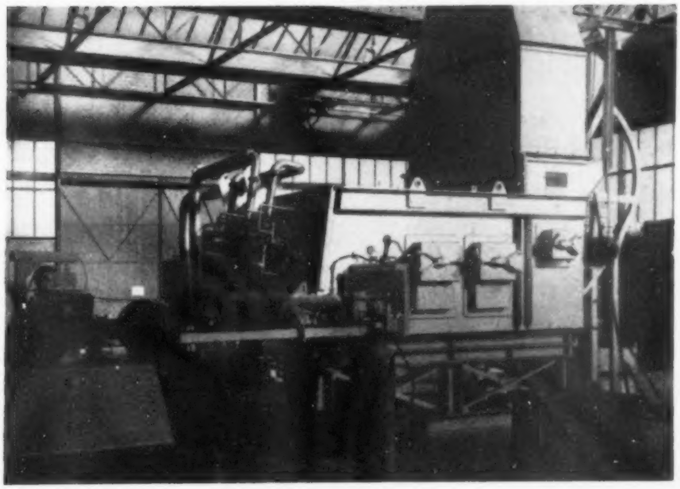


Fig. 2.—(left) Sklenar melting furnace. At the front of furnace, oil burners. Side of furnace from left to right, pouring spout with automatic flow control. Behind this, three cleaning doors. At back of furnace, the furnace charger

2. The total height of the machine could be kept lower by adopting smaller diameter pulleys. This means that the foundation costs are reduced as the machine does not need to be mounted into a pit.

3. The drying section between the back bottom and back top pulleys is now vertical which simplifies to a great extent the mounting of the dryers.

4. All free running parts of the belt have been shortened which reduces to a great extent the unavoidable buckling of the belt due to the constant change in temperature.

Tensioning of the belt, the pressing of same onto the casting rim and lifting it for belt changes is done pneumatically. All belt-pulleys are equipped with outboard bearings, so guaranteeing parallel running of the belt. All outboard bearings are however, designed in such a manner that they are placed within the track of the belt and form no obstruction when the belt requires changing.

The casting machine is driven by a 5-h.p. d.c. motor with a constant torque range of 4:1.

The control desk is placed close to the casting wheel, giving the operator unobstructed visibility of the metal pool. A Perspex wall protects the operator from metal splashes. The electric controls are mounted separately from the pneumatic valves and are clearly defined, but in easy reach of the operator.

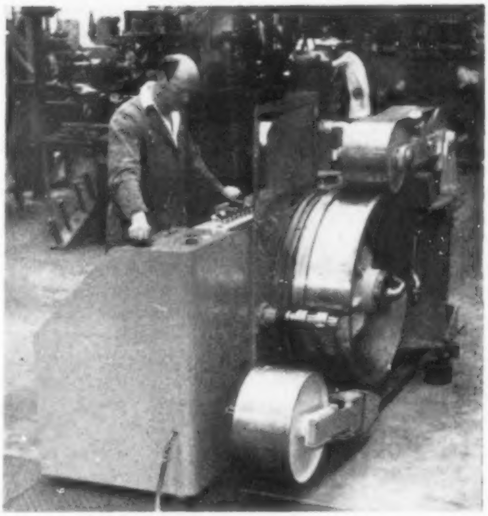


Fig. 3.—Rotary casting machine Mk. III. To the left of the operator, electronic control push buttons and indicator lamps. On his right pneumatic controls for tensioning and lifting of the mild-steel belt. Very clearly shown is the groove in the rim of the casting wheel, which is covered by the endless mild-steel belt, so forming the mould for the cast strip. The shown machine is a right-hand design which means that the molten metal is fed from the right-hand side through a launder, ending in a fishtail, to the casting wheel and poured into the groove at the point where the mild-steel belt is held on to the rim. Water sprays are mounted inside the wheel rims and behind the same (not to be seen in the photograph as covered by the wheel itself) and cool the aluminium rapidly but steadily. The solidifying of the metal starts immediately after coming into contact with the casting wheel and the mild-steel band and takes place over a length of approximately 24 in. After this, the strip is completely solidified and when leaving the wheel has a temperature of approximately 500° C.

Rolling Mills on the American Line

Both rolling mills are identical, differing only in the rolling speed as they run in tandem. The speeds are matched with the reductions and the screwdown speed of the electric screwdown of the second mill is slower than on the first mill so allowing a finer adjustment on a thinner strip.

When designing the rolling mills conventional rules and generally acknowledged practice could not be adopted and new ways and means had to be found in many cases in order to meet the required characteristics of these lines and were of great importance for their economy. As the rolling mills have to match the mean casting speed of approximately 15 ft. per min., they are very slow-running mills, but their driving elements have to transmit considerable torques due to the high reductions. (The maximum reduction in one pass is 66 per cent). This is one of the reasons why special needle roller bearings have been chosen as roll-neck bearings, which allow a neck diameter of approximately 67 per cent of the barrel diameter. This design allows high separating forces with the comparatively small barrel diameter which results in lower driving power. The needles of these needle bearings are safeguarded against misalignment by bronze cages and run without an inner race direct on the hardened roll necks. For cooling and lubricating purposes they are constantly supplied with cooled and filtered oil by an oil circulating system. A soluble-oil circulating system with a capacity of approximately 80 gal. per min. feeds the coolant to both rolling mills. In the tank, which has a capacity of approximately 1,000 gallons, the coolant is kept automatically to a constant temperature by means of thermostatically controlled immersion heaters. From here the coolant is not only sprayed onto the rolls but is fed also into the bored rolls themselves and into the chocks which are equipped with internal cooling ducts. This helps to a great extent to keep the temperature of the bearings and roll journals constant thereby avoiding variations in bearing clearances which again reduces the wear and increases the accuracy of the strip.

The cross-sectional area of the mill frames is chosen far in excess of that required by the separating force, so that in addition, temperature variations in the strip (which should be avoided as far as possible) do not result in uneven stretching of the posts, which would mean an inaccurate strip.

The rolls are adjusted electrically on the first mill stand at a speed of 2 in. per min., on the second at ½ in. per min. Normally, however, the rolls are only adjusted during the start-up period of the line and until all varying factors have been stabilized. The most important of these variables are the heating up of the rolls, the amount of coolant and the adjustment of the two reductions in order to get a well-balanced loading of the two mills.

The two frames of each rolling mill are connected at their heads by bridge pieces which increase the rigidity of the mills and at the same time supply adequate and very suitable space for mounting of the hydraulic roll-balancing cylinders. These hydraulic roll-balancing units keep the top chocks constantly pressed up against the setting screws during lifting or lowering. This design avoids the removing of clamps, unscrewing of bolts or pressure-oil connexions, etc., so that a roll change can be done in the shortest possible time, without the need for skilled maintenance workers, by the mill operators themselves.

A pair of horizontally adjustable edging rolls is mounted on the entry side of the first rolling mill which roll the slightly tapered edges of the cast strip, so giving the strip a rectangular shape and reducing it by approximately ¼ in. in width. This edge rolling is important as it helps to avoid edge cracking during subsequent rolling processes. A second pair of edging rolls placed further away from the mill, guide the strip, and horizontal hydraulically-operated pinch rolls prevent buckling of the strip between the edging rolls.

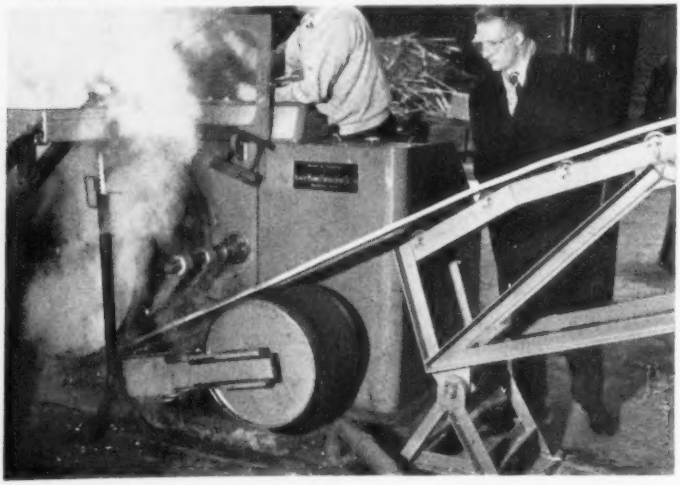


Fig. 4.—The solidified strip after leaving the casting wheel

Fig. 5 (right).—Cast strip on its way from casting machine to rolling mill

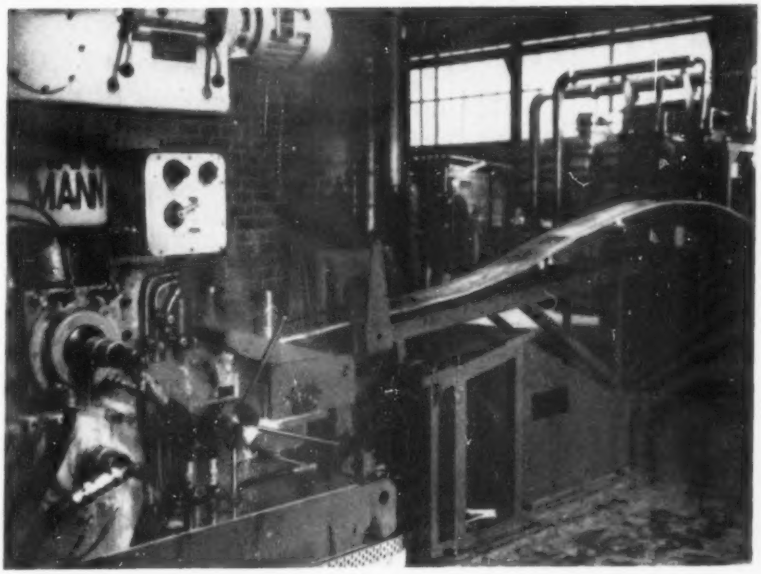
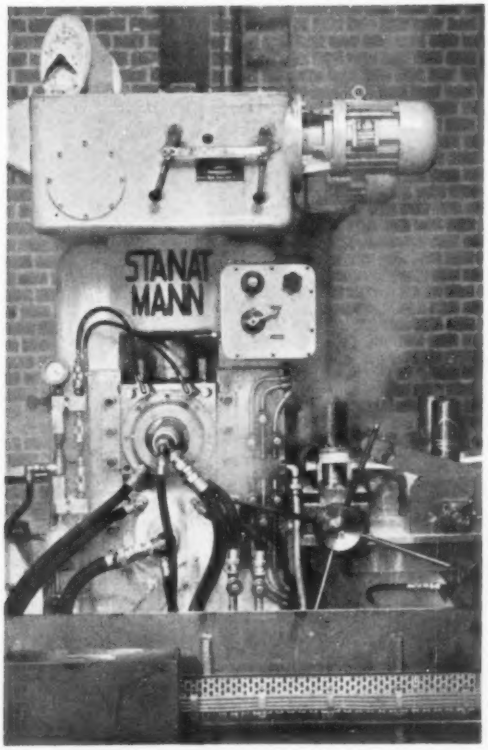


Fig. 6 (below).—Hot-rolling mill. On the entry side clearly to be seen, the two pairs of edging rolls and the hydraulically loaded pinch rolls



On the exit side of this first mill an hydraulically-operated flying shear is mounted which cuts the strip as soon as it has been coiled to the required coil diameter. The shear is operated automatically by means of solenoid valves which receive their signal from the adjustable contact rollers on the recoilers. The shear itself is flanged to the base of the mill, and is mounted together with the mill on a common foundation so guaranteeing absolute rigidity.

As the shear is a very important part of the continuously working line, special care had to be taken to ensure that safe and faultless operation is maintained under all prevailing circumstances. The operating speed of the shear is in fact variable over the full range of speeds of the rolling mill and can be adjusted down to the casting speed. When working under normal circumstances the shear makes one cut and then returns to its rest position. For safety reasons, however, the shear can be switched onto continuous operation whereby the strip coming out of the rolling mill is cut up into short pieces during which time any holdup that might occur between the rolling mill and coilers can be cleared without the necessity of interrupting the continuous casting process. Mechanically and hydraulically the shear is designed strong enough to cut $\frac{3}{4}$-in cast aluminium strip, should it for some reason or other pass the rolling mill without any reduction, this also being the reason why the speed of the shear can be adjusted down to casting speed.

The first rolling mill is driven by a 75-h.p. d.c. motor with a constant torque range, through a double reduction gear (first reduction worm;

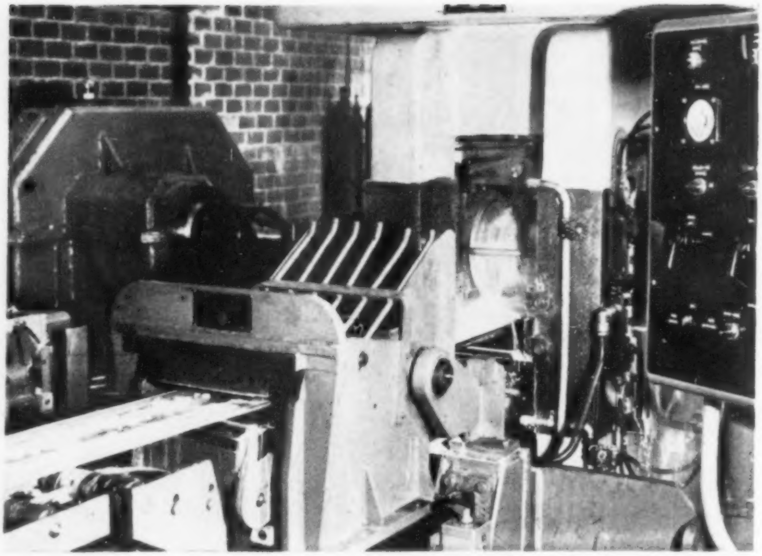


Fig. 7.—Hydraulic travelling shear on exit side of hot-rolling mill. Here the strip has been reduced from 19 mm. to 9 mm. Photograph shows the shear just starting to cut

second double helical) pinions and heavy universal joints. The rolling speed is infinitely variable up to 60 ft. per min.

The second rolling mill is identical with the first one, reducing the initial cost, and cost of spares such as rolls, bearings, seals, etc. This rolling mill is also driven by a 75-h.p. d.c. motor with the same characteristics. The reduction gearbox is, however, designed for a maximum speed of 90 ft. per min. On the exit side of this second mill, the strip is guided by a system of gates and roller tracks to the twin recoilers. When one coil has reached the required diameter, the strip is cut by the hydraulic shear and as soon as the strip leaves the second rolling mill the coiler automatically accelerates as the strip tension is reduced. By this method a gap is formed between the end of the first coil and beginning of the following strip which allows the gates to perform their movements in order to guide the next strip onto the second recoiler.

Each coiler is driven by a 10-h.p. d.c. motor with a constant horsepower range of 3:1.

The driving motors of the casting machine, the two rolling mills, and the two recoilers are supplied by one generator set and are electronically controlled. The coolant circulating system, the hydraulic power station as well as the roll-neck lubricating system are interlocked with the main drives.

To avoid the possibility of the strip tearing or being pulled out of the casting wheel due to inattendance of the operator, the strip is fed in a loop over a counterbalanced bridge-piece between the caster and the rolling mill. This bridge-piece operates a potentiometer which in turn regulates the rolling-mill speed. Between the two rolling mills a very slight continuous loop is maintained which synchronizes the speed of the second stand with the first stand should speed changes occur due to reduction adjustments. As the coilers work with constant tension they automatically follow every variation of the rolling speed.

Capacity of the Installation

The melting furnace has a capacity of 6,000 lb. per hour and theoretically the line can be operated continuously as the furnace can be charged during the pouring operation. The Sklenar furnaces are exceptionally suitable for this type of operation as with them it is possible to pour direct from the furnace without using a holding furnace which simplifies and cheapens the installation considerably. If it is intended, however, to run the line on a fully continuous basis, then it is always advisable to use two furnaces and pour from them alternatively. For the time being the American line has been supplied with one furnace but during erection the space has been reserved for the installation of the second furnace at a later date. Considering, however, the capacity of such a line, it will be appreciated that demand does not very often require the full output. Taking $\frac{3}{4}$ in. $\times$ 8 in. aluminium cast strip and a casting speed of 15 ft. per min. the output would be approximately 6,000 lb. of finished slug stock per hour.

Economy of the Line

The costs can be easily calculated. The capital expenditure for a line with 200 installed kilowatts is approximately £60,000 to £65,000. Adding the local costs for four operators (including the furnace)

the prevailing price for pig and the melting costs, which are the main governing factors, it will be realized what reasonable production costs can be achieved.

When calculating the melting costs it is necessary to take into consideration approximately one per cent melting losses and the required oil consumption, (the Dutch line is operated with an oil-fired furnace whereas the American line has a gas-fired furnace) which is approx. 25 gallons per ton of aluminium melted. When using Sklenar furnaces this amount can possibly be reduced. Another very important factor which must not be overlooked when calculating the economics of such a line is the amount of rolling work necessary to achieve the required end product. This factor becomes apparent when the two extremes are compared. The most economical product would be strip which requires only one or two hot reductions in order to satisfy the requirements with respect to end thickness, surface finish and metallurgical properties of the strip. The least economical product would be aluminium foil as the effective rolling costs (not taking the capital expenditure into account) for narrow strip are not less than the rolling costs for wide strip. On the contrary they exceed the costs for wide strip if based on weight units. This makes it quite clear that these lines are not of such great interest for plants which already possess large and expensive sheet and wide strip mills, as they are for the end user of large quantities of slugs or of narrow strip. One exception may perhaps be that of a large plant requiring to extend their capacity for one special product.

The Dutch Line (Figs. 2 to 10)

This line was mainly designed for more moderate European conditions and was laid out for present demand only with the possibility of increasing the output by adding on units at a later date. As the European wage structure is so different from that in the U.S.A., the labour-saving features of this line are not as pronounced as on the American line. Automatic operation has been introduced only where it is essential for the quality of the strip or for continuous and absolutely safe working of the installation. For instance, the automatic feeding of the strip into the coilers was not adopted here, as the strip is coiled after one reduction in the first rolling mill, and therefore, only runs at half the speed. The feeding of the strip into the coilers is left to an operator as, in any case, one man has to be available for removing the coils.

At present the line consists of one 6,000-lb. melting furnace, one rotary casting machine, one rolling mill, an hydraulic shear and two recoilers. In addition and separate from this unit a two-stand four-high tandem mill has been installed as a finishing mill and one rotary gang slitter for further processing.

As the strip produced on this line is not used mainly for slugs, but forms mostly stock for other products, the cold reduction has to start after one hot-rolling pass. For this reason the rolling mill was designed in such a manner that it can be converted very quickly into a cold breaking-down mill. The present output requirements permit cold breaking-down passes on the same rolling mill during which time the casting machine is not in operation. While the rotary casting machine is not in use the furnace feeds a semi-continuous billet casting machine, so that the furnace operators are continuously engaged.

Converting the hot mill into a cold mill takes approximately two hours. The complete set of hot rolls is withdrawn from the frames and replaced

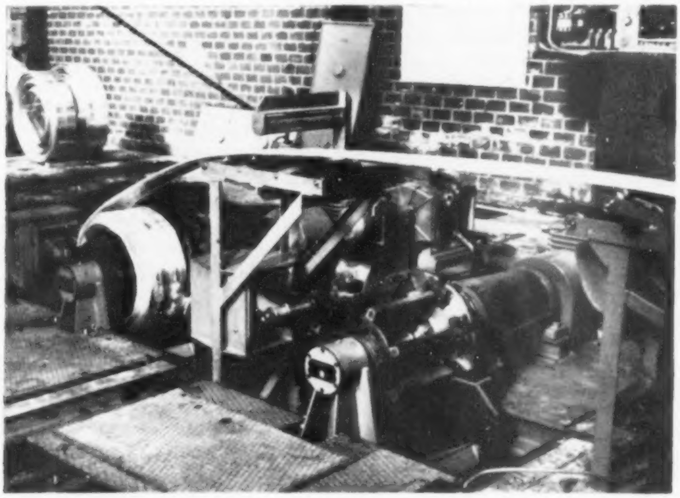


Fig. 8.—The 9-mm. strip being coiled on Coiler No. 2. Coiler No. 1 standing by to accept the next coil. Behind the coilers the contact rollers. In the background, finished coils

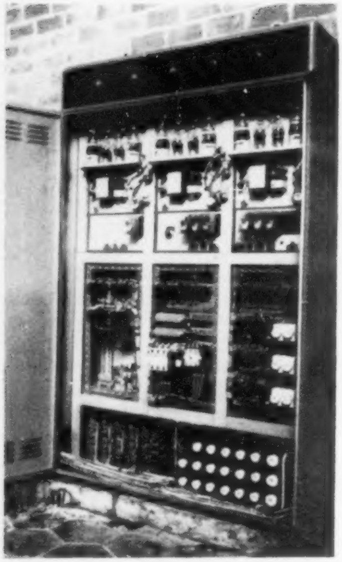
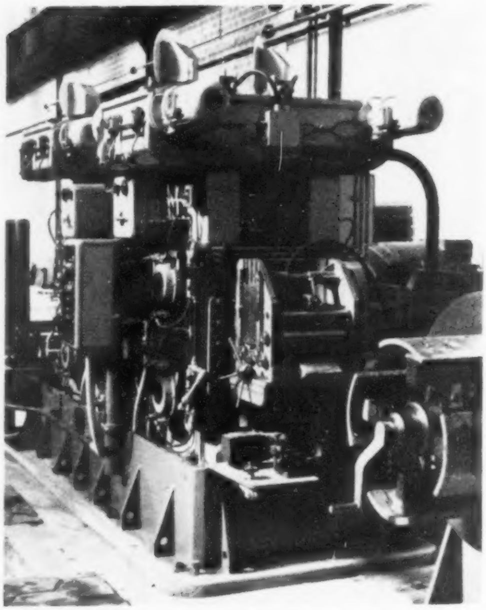


Fig. 9 (left).—Electronic control panel for casting and rolling line

Fig. 10 (right).—Tandem cold-rolling mill shown from the entry side



by a set of cold rolls. The uncoiling box with roller leveller, which during hot operation is covered by a roller table, is uncovered simply by removing the swivelling portion of the roller table, and a sleeve is mounted onto the drum of the front spider recoiler. As this work has only to be carried out approximately once a month by the mill operators themselves to achieve the present output programme, the required time of two hours has little effect on the economy of the line.

Strip which has reached final gauge after one or two cold breaking-down passes *i.e.* any gauge down to 0.100 in., is removed from the line and forms the stock for the blanking presses for slugs or for the tube welding line. All other strip receives its normal heat treatment and then further reductions on the tandem cold line.

When at a future date increased output is required a further furnace will be installed and a separate cold breaking down mill will be erected behind the coilers of the hot mill. The complete set of rolls including chocks and bearings is already available for this second mill. The pay-off box with the roller leveller will be moved from the entry side of the hot mill to the entry side of this new cold breaking down mill. To increase the output of narrow thin strip on the tandem line, a third stand would be added between the second stand and the recoiler. All the necessary foundations for the second stage have been laid at the same time as foundations for the first erection stage, so that at the later date, when the extension takes place, the production only needs to be interrupted for a very short time and no earth moving needs to be carried out. The electronic control gear for the tandem mill has been designed in such a manner that the controls for the third stand can be included with the least possible cost and labour.

All tanks and pumping stations for both soluble oil on the hot line, and rolling oil on the cold tandem line, together with all hydraulic power packs have been placed in specially built cellars which again are large enough to take the equipment for further extensions.

The output of the complete installation is very difficult to determine as it depends largely on how much of the strip can be regarded as finished after the first or second cold reduction and how much of the strip has to be re-rolled. It is easily recognized however that the described extensions can double the output of the present line with very little additional capital expenditure.

As the most suitable strip width for this casting line 9 in. was chosen to produce a finished edged trimmed strip of 8 in. Naturally any narrower width than 8 in. can be slit on the rotary slitting line to suit all requirements of the tube welding installation.

As this is a continuous casting process any sizes of coil can be produced but when determining the size of coil, one should watch very carefully whether the advantages of a large coil in fact justify the higher expense of the complicated coiler drives and the annealing plant. In this line a diameter of 40 in. has been chosen as this size coil only requires coiler motors with a constant horsepower range of

(*Continued in page* 582)

Development and Present Position of Installations for the

MANUFACTURE OF COLD-FORGED COMPONENTS

By Dr.-Ing. H. D. FELDMANN*

(A paper presented at the Special Conference on "Cold Extrusion of Steel," organized by the Institute of Sheet Metal Engineering, Sheffield, November, 1960)

THE continual development of the cold-forging process and the production of components for the various fields of application, raises the question as to which machines and equipment are available today for an economic exploitation of this process. It has been repeatedly pointed out that cold forging, like most other special processes, demands certain requirements from machines and equipment.

While in former times the manufacturers produced certain standard machines and the consumers adapted their production to these machines, today's processes compel the machine manufacturers to adapt machines and equipment to customer requirements, *i.e.* there is a tendency towards special machines.

Cold forging is described today as a follow-on or combination process of various forming operations, *e.g.* upsetting, preforming, extruding, reducing, sizing, coining and others, and machines and equipment need therefore to be versatile.

With cold forging, it is practical to distinguish between main machines and ancillary installations. All cutting and forming operations are carried out on the main machines, the ancillary installation being used for all intermediate treatments, *i.e.* heat treatment and surface treatment.

The principal machines have to produce a certain pressure at a certain point so that each individual operation can be carried out. Each operation can be characterized best by the load-displacement diagram (Fig. 1 shows the different working diagrams for each cold-forming operation).

It is necessary in order to effect any operation that the machine should have a sufficient capacity and it is therefore essential that characteristic working diagrams are used for the machines. The load-displacement diagrams are determined by the type of drive for each machine. Fig. 2 shows the load-displacement diagrams of some typical presses in current use. By using the working diagrams of each forming operation in conjunction with the working diagrams of the presses, the following is obtained :

(1) For impact extrusion, coining calibrating, and flattening, and possibly for piercing and blanking, the knuckle-joint press is most suitable. Only in special cases should the machine be used for any other forming processes. Whenever high pressure for a long period is required, this machine is un-economical.

(2) Crank presses are to be preferred for cropping, upsetting, piercing and blanking, indenting, extruding, combined reducing, and coining. These machines become un-economical when long ram strokes and pressures over 1,000 tons are required.

(3) Hydraulic presses are to be preferred for further reducing, necking and extrusion at pressures of over 1,000 tons, or when long ram strokes are required.

A further characteristic is the work capacity. In the work diagrams of the forming operations (Fig. 1), the work required is shown by the hatched area in mm.t. The work capacity of the presses may also be observed from the work diagrams as a hatched area in mm.t. (Fig. 2).

On comparing the work required by the forming operations (Fig. 1), with the work capacity of the presses (Fig. 2), it is found that the former must be less than the latter.

The knuckle-joint press has the smallest work capacity. For greater work capacity an oversized machine is required but this tends to be un-economical.

The work capacity of a crank press is limited more than that of the hydraulic press. Important factors when comparing machines are the speed of operation, the motor power, and the price.

With regard to the speed of the machine, the vital considerations are the striking velocity, working

*Cold Forging Ltd.

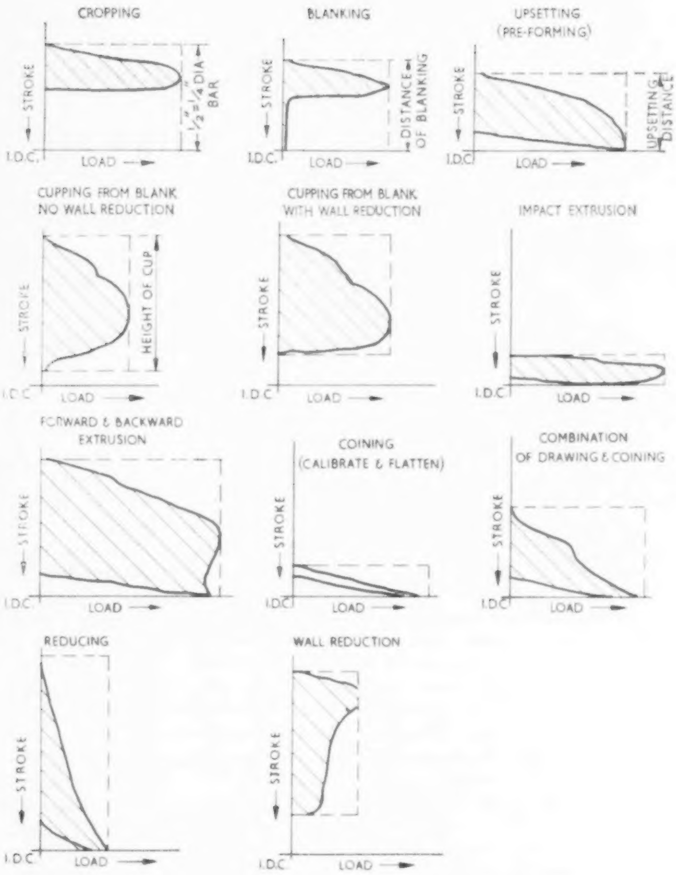


Fig. 1.—Load and stroke diagrams of various cold-forging operations; work diagrams of forming operations

velocity, final velocity, and the number of strokes per minute. When the forming process itself is under consideration, the influence of velocity (striking, working and final), is from a practical point of view, in the range of speeds available on present machines. Certain cases may exist when the so-called "creeping" of metals is favourably utilized by maintaining the pressure in the final position. It is certain that the striking velocity and the working velocity influence tool life.

High working speeds inevitably produce more heat and cause greater wear on the tools. From this point of view, lower striking velocities are to be preferred, but not to the extent of using the machine un-economically. If a machine produces 180 work-pieces per hour when it could have produced 1,800, it is obviously using only one-tenth of its production potentiality. In the latter case the cost per article is 10 times smaller than in the first instance.

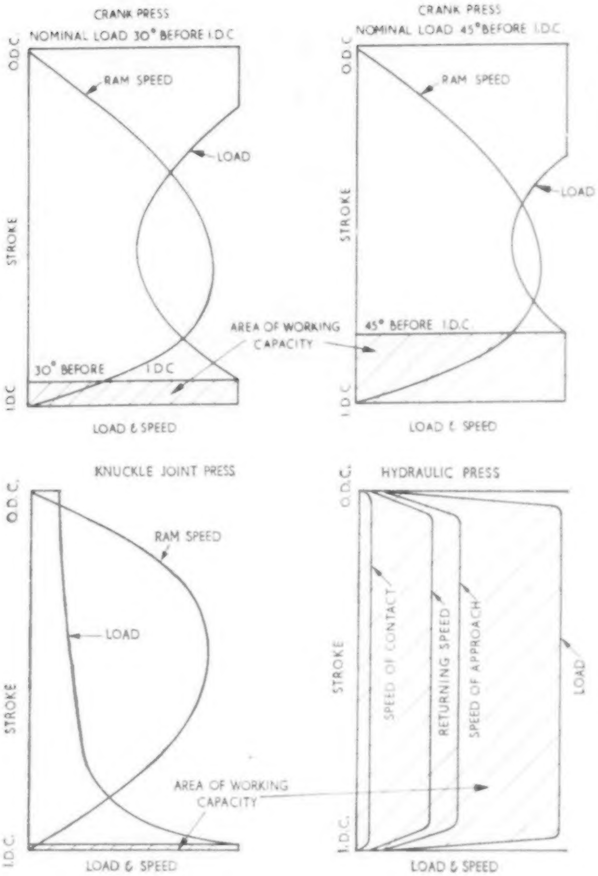
The number of strokes is limited in the upper range, owing to economic tool life which depends upon striking pressure, wear, and development of heat; the speed of the automatic feeding device is limited too.

For a mechanical press the number of strokes depends on the length of one stroke and on the number of revolutions; for a hydraulic press on the speed at which the oil flows, and all of these are dependent on the machine loading.

From the author's experience the following types of machines for practical cold forging are best utilized as follows:

(1) For loads up to 1,000 tons and strokes up to 32 in. (800 mm.)—mechanical crank presses with 5 to 120 strokes per minute, depending on load and the number of strokes.

(2) For loads up to 1,000 tons but stroke larger than 32 in. (800 mm.)—hydraulic presses, rack and pinion presses with strokes of 2 to 20 per minute,



depending on load and stroke.

(3) For loads over 1,000 tons with a stroke larger than 16 in. (400 mm).—hydraulic presses with strokes of 3 to 30 per minute, depending on load and stroke.

(4) For loads over 1,000 tons, stroke smaller than 16 in. (400 mm.)—mechanical presses with strokes from 10 to 40 per minute.

The first part of Table I shows some of the characteristics required by presses for cold forging, the information being based on many years experience in this field.

The second part of the table shows a comparison between various types of presses, available today with respect to nominal load, power, speed and price.

From this, it can be concluded that in general terms the most suitable press is up to 200 tons a cold header, from 200 tons to 800 tons a crank press, and over 800 tons, a hydraulic press.

For certain operations where there is a high tonnage (up to 400 tons), over a short stroke and with a small work capacity, a knuckle-joint press may be suitable.

Practical experience has indicated that the above characteristics must bear a constant relationship to one another. However, this relationship varies from country to country according to the level of wages, availability of labour, and degree of industrialization. For instance, in America where wages

Fig. 2 (above).—Load and stroke diagrams for various presses

Fig. 3 (right).—COLFORG cropping machine

TABLE I

Approximate Required Data in the Cold Forging Process obtained through Experience.

Force (ton)	50	100	200	400	800	1,000	1,600
Stroke (in.)	4	4	4	8	16	32	64
Work (in-ton).. ..	15	30	60	250	850	2,000	7,000

Approximate Data of Machines Available on the Market

Cold header (5 operations)	Nominal load (ton) ..	80	130	250	—	—	—	—
	Power (h.p.)	15	20	30	—	—	—	—
	Speed (st. /min.) ..	140	70–100	60–90	—	—	—	—
	Price (£)	16,000	23,000	28,000	—	—	—	—
Knuckle joint Presses	Nominal load (ton) ..	—	200*	300*	—	—	—	—
	Power (h.p.)	—	12	30	—	—	—	—
	Speed (st. /min.) ..	—	70–100	85	—	—	—	—
	Price (£)	—	5,000	7,000	—	—	—	—
Crank Presses	Nominal load (ton) ..	—	—	200	400	800	—	—
	Power (h.p.)	—	—	30	70	80	—	—
	Speed (st. /min.) ..	—	—	60	45	20	—	—
	Price (£)	—	—	9,000	12,000	22,000	—	—
Hydraulic presses	Nominal load (ton) ..	—	—	200	400	800	1,000	1,600
	Power (h.p.)	—	—	75	80	150	200	350
	Speed (st. /min.) ..	—	—	16	16	10	8	5
	Price (£)	—	—	7,000	9,200	12,500	14,000	26,000
	Best economy :	Cold header		Crank Press		Hydraulic press		

* High nominal tonnage required on account of low work capacity.

are high, it is often economic to pay more for a machine and its installation which gives a high production rate, in order to save on labour costs.

During recent years both mechanical and hydraulic presses have been tried out for cold forging, some successfully, and some unsuccessfully. In all cases these machines were built by machine manufacturers, who have had no opportunity to test the machines in mass-production. It would be too early to say, whether or not these presses in their ultimate form will prove satisfactory, since the users of these machines have not yet given their public opinion on this matter; the author believes that this is because they fear competitors might employ the same machines.

This situation made Cold Forging Ltd. decide to build special machines and equipment for cold forging, which would be tested in their own cold forging factories. This, it is felt, would enable the author's company to improve the machines and equipment to as near perfection as possible, according to their special practical requirements.

The programme covers the necessary machines and equipment for the COLFORG process, which are :

(1) Machines for producing the initial slug ;
(2) Ancillary machines for intermediate treatments ;
(3) Machines for various cold-forging operations.

The precise manufacture of the basic slug is extremely important for cold forging. As yet no suitable machines have been available for these operations. The cropping machines which have been on the market were built mainly for cutting off slugs for hot forging. For this reason, most companies attempting to set up cold-forging

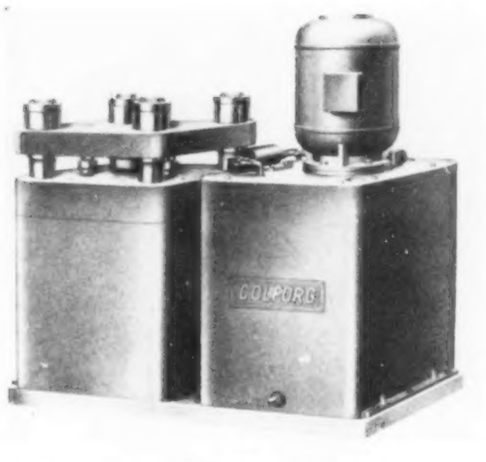


Fig. 4 (above).—COLFORG preforming machine

Fig. 5 (right).—COLFORG chamfering-deburring machine

operations have had to start off from sawn or from parted off slugs. This production method is naturally very expensive and inefficient.

For ten years the author has been working successfully with hot-rolled bar sections, which are produced by cropping from bar or wire. During this time the cropping technique has been developed to such an extent that even in soft steel crops of a length only one quarter of the diameter can be obtained. For this purpose three different cropping machines are used (Fig. 3), the data of which is as follows :

	Cropping dia.	Min. length which can be cropped	Max. cropping length	Strokes per min.	Shear strength of material in tons per sq. in.
S 25	1 in.	¼ of dia.	2 in.	60	12–42
S 50	2 in.	¼ of dia.	4 in.	45	12–42
S 75	3 in.	¼ of dia.	6 in.	30	12–42

Preforming machines are built to match the cropping machines (Fig. 4) :

	Max. dia. inch.	Load in tons	Strokes in inches	Number of strokes per min.	Overall dim. l × b × h
HV 25	1 in.	100	0.34	60	38 × 27 × 28 in.
HV 50	2 in.	400	0.79	45	38 × 27 × 28 in.
HV 75	3 in.	1000	01.2	30	38 × 27 × 28 in.

With the COLFORG preforming machines, which are hydraulically driven, it is possible to produce the basic slug with plane parallel surfaces with a thickness of about 0.15 × diameter, which today can only be produced by blanking from flat material or sawing off bar material, with a resultant large amount of scrap.

Preforming may also be done by centering, or by chamfering the side with the larger burr to prevent it being pressed into the material. The tolerance in weight of these basic slugs is about 3 per cent. The cropping and preforming machines are normally connected by an automatic transfer device, such as a conveyor chain so that continuous working is obtained. It has, in fact, been necessary to employ special staff to devise these feed systems and the initial results will prove of interest.

A combined cropping preforming machine is produced for various diameters. The load displacement diagrams of the machine is utilized over the working stroke, so that cropping may be effected at t.d.c. and preforming at b.d.c. of the ram. These machines are specially recommended for smaller diameters up to 1 in. A special COLFORG machine has been developed (Fig. 5) for chamfering the burr, which will occur, especially on large diameters. This chamfering machine can be supplied in two different sizes : for diameters up to 2 in. and for diameters up to 3 in. This chamfering machine has an output of 30 to 120 components per minute ; it is also connected to the cropping preforming machine by an automatic transfer device. A film will be shown which demonstrates the exact operations.

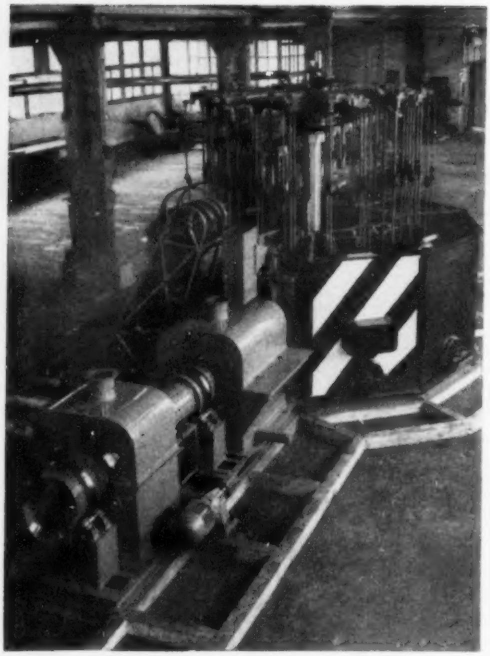


Fig. 6.—COLFORG surface-treatment plant

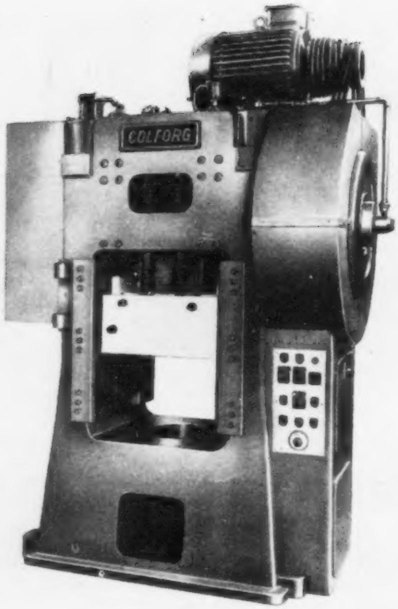


Fig. 7.—Cold-forging machine, COLFORG type P 300

There follows, according to requirements, a soft or recrystallization annealing. In every country there are sufficient specialists, who are capable of producing such plants (annealing furnaces). However, the author recommends that these machines are built according to his instructions. With surface treatment plant it is different. As a result of many years experience it has been possible to build such a plant, since the plant previously available did not satisfy the requirements. The surface treatment plant has to comply with the chemical and mechanical requirements of the process. Most existing installations, however, do not fulfil these requirements ; the reason for this is that usually the necessary experience is lacking.

Pickling, rinsing, and phosphating must be carried out with extreme care and accuracy as surface treatment greatly influences tool-life, and surface finish of the components. Fig. 6 shows a COLFORG surface treatment plant with its separate lubricating device. This plant is built on a rotary system and is hydraulically driven. The entire scheduling is effected from a column in the middle of the machine. The drums, containing the components for treatment are transported from one bath to another by being lifted in and out (at the same time) being tipped gradually to an angle of about 40 deg. The loading, unloading, opening and closing of the drums is done hydraulically. The surface treatment plant covers the following working operations : degreasing, pickling in two containers, two rinses, phosphating in two containers, two rinses. The components are loaded into the drums, according to weight and size. The heating of the baths has been specially taken care of by installing an entirely new system in which the heating elements guarantee an equal temperature in each bath ; they work economically and they can easily be cleaned.

Lubricants such as soaps, oils, etc., do not come in contact with the drums as the separate lubricating device has been designed for this purpose and this method also avoids a frequent change of the pickling- and phosphating-bath and guarantees a near perfect surface treatment. The use of lubricants is optional, and maybe soaps or oils; lubrication may also be effected on the cold-forging machine itself.

The lubricating device consists of a rotating worm, which transports the components slowly through the lubricant, and if necessary, the component may be fed through a drying zone. The working cycle of the surface treatment plant may be set, within limitations of 4 to 8 minutes, according

used for cold forging today. It is necessary to repeat, however, that all these machines appear to have considerable faults, which can be minimized only by carefully meeting the following main requirements.

(1) Nominal load to be effective at a long distance before b.d.c. and large work capacity.

(2) The machines should be extremely rigid and show no sign of spring between table and ram, even under eccentric loads.

(3) The ram guides should be extremely long, so that during the operation the entire ram guide is effective thus prolonging tool life and maintaining the accuracy of the components.

(4) Clutch and brake to be highest quality in order to make perfect and fast tool and feeding device assembly possible, maximum control capabilities, and small braking distances.

(5) Care is to be taken with the ejector where special construction is required.

(6) The number of strokes should be high to guarantee the economic utilization of the machine.

These main requirements have been considered in the COLFORG forging plant. It was decided initially that smaller rather than larger components were suitable for cold forging, and for this reason machines were first built, with a pressure of 200 tons and 400 tons, at a 30 deg. crank angle before b.d.c., and a stroke of 100 to 150 mm. Figs. 7 and 8 show the COLFORG cold forging machine P 300 and P 302.

The dimensions of the COLFORG cold forging machines and their entire construction, were

Fig. 8.—Cold-forging machine, COLFORG type P 302

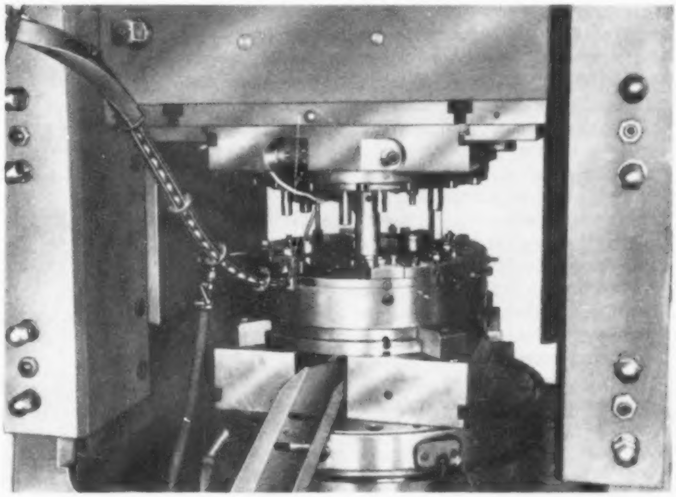


Fig. 9.—COLFORG multi-die tool with automatic feed

to the time required for each individual treatment in the various baths. The construction of the drums depends upon the shape and size of the components, and upon the required input. The plant shown in the leaflet was designed for components up to about 500 gm., the load per drum being 40 to 45 kg.

At the beginning the author expressed his opinion and experience of non-specialist machines

designed from practical cold forging techniques. Cold Forging Ltd. have aimed at and succeeded in building machines and ancillary equipment to suit the special requirements necessary when producing cold-forged components economically in continuous mass production.

The first phase in the COLFORG machine programme is the following :

No.	Type	Pressure 30° before b.d.c.	Stroke mm.	Number of strokes per min.
P. 300	mech.	200 tons	100–200	60–90
P. 302	mech.	400 tons	120–140	45–90
P. 800	mech.	800 tons	300–400	30–60
PH 1 600*	hydr.	1 600 tons	500–1200	3–10
PH 3 200*	hydr.	3 200 tons	500–1200	2–8

*Now in preparation

All machines are equipped with a special ejector and with a modern electrical control system, according to latest technical developments.

Mechanical Machines

The housing of these machines, consisting of one or several parts, are of welded construction or cast steel. The machine table is of specially heavy construction. Altogether it is a rigid system with a high stiffness and this still applies with eccentric loading.

The plain design of the machine table and stand facilitates the fitting and dismantling of the tools and also special feeding devices. The machine has a large motor with a detachable pulley belt, or with three-speed poles arranged so that the number of strokes of the machine is adjustable in stages. Between the flywheel and the eccentric shaft epicyclic gearing is installed and this helps to stop the great inertia force more quickly. This large inertia force is essential for the working capacity of the machine ; the quick stopping is required for tool adjustment and for safety. The epicyclic gearing guarantees furthermore an almost silent running of the machine and an equalization of gear tooth pressure on the planets.

The crankshaft is carried by large bronze bearings and is connected to the ram by a short connecting rod *via* a ball bearing at the big end and a ball at the small end seat. Adjustment of the ram is effected by a worm screw at the ball spindle. For weight compensation and damping, the ram is suspended on four strong springs, connected to the yoke of the machine.

The unusually long ram guides can be adjusted easily by means of a wedge mechanism which gives perfect alignment over the whole length. The ejector construction is effected according to the requirements of the machine—*i.e.* ejector load and stroke being considered. It is important that this is related to the time stroke diagram, which is done by means of a cam, easily changeable, and provided for fine adjustment. The machines are equipped with automatic oil circulating lubrication. As an overload protection an electric device is installed, which stops the machine at once when the capacity is reached.

COLFORG cold-forging machines are arranged so that they can work with single tools or multi-stage-tools (Fig. 9). The bottom tools are arranged within a block, together with feeding devices, which transport the components from one operation to another. The top tools are also arranged in one unit. Both tool blocks can be fitted and dismantled quite simply. The correct arrangement of top and bottom tools is carried out in the tool shop. This makes it possible to keep preparation time down to a minimum. Attached to the machine is a feeding container, in which a magnetic rotating disc picks up the components and transports them *via* a feeding channel to the working tools of the machine. The tool itself carries out the rest of the feeding, by means of its own indexing plate.

Hydraulic Machines

The hydraulic machines, which are on the market today appear to be unsatisfactory, and for cold forging their economy is limited. The experience gained by the author from cold forging of munition parts in mass production in the U.S.A., France and Germany on hydraulic presses has been of great value. Based on this experience and on the newest developments in hydraulics, the author's company have recently formulated the design for a series of hydraulic cold forging machines, which, it is felt, will be the most efficient and economic hydraulic machines currently possible, in the present state of technical knowledge.

It is expected that in 1961, it will be possible to instal the first of these machines for mass production trials, and it is hoped that by creating these special machines and equipment it will be possible to provide a further economy of working, and that different fields of application may be opened up in the expanding cold-forging industry.

Generally, the author considers, with all humility, that in the COLFORG system the principles of cold-forging theory have been combined, as detailed in "Fliesspressen von Stahl,"* with the practical experience of an international team of specialists in cold forging ; and that the machines described will form the long-term basis of the vast development which lies ahead for the cold-forging industry.

In conclusion the author, as a stranger in the U.K., and who heads a technical team of British, German and French technicians working in three countries—Britain, Germany and France—cannot over-emphasize the extreme pleasure he has derived from the international associations at Cold

Fliesspressen von Stahl, by Dr. Heinz D. Feldmann, published by Springer-Verlag, 1959 (in German). English version to be published by Hutchinson.

Forging Ltd. Much benefit has accrued from this international exchange of ideas, knowledge and personal acquaintance, and above all the pooling of the main experience of all three countries is the reason it has been possible so quickly to develop this complete cold-forging process from raw stock to finished component.

The author takes personal pleasure at being invited to address this Conference which, he is sure, marks the birth of a soundly-based cold-forging industry in which Britain will now be among the leaders.

DISCUSSION

Mr. GRANBY (Paul Granby and Co. Ltd,) said he had noticed that the slug had been severely chamfered. What was the reason for this ?

Dr. FELDMANN said that his experience was that if diameters over 20 mm. were cropped a burr was produced and this had to be shed.

Mr. GRANBY said that he was partly in agreement on this point, but wondered whether it had also been done to increase extrusion speed. His own experience had been that if the slug was chamfered as severely as shown it would increase the extrusion speed greatly ; but that the cost of the intermediate operation was such as to not make it worth while doing in every case.

Dr. FELDMANN said that assuming the diameter was 1 in. there was no choice but to chamfer.

Mr. MORGAN (R.O.F., Birtley) said that it was very interesting to see the cutting of the billet shown. He wondered whether it was true cutting, because some of the low-carbon steels (not those made in Sheffield !) tended to tear. In armaments it was better to be sure than sorry. Everyone concerned had to be satisfied that there was not a tear present which was covered by a massive extrusion. The consequence of that was an incipient crack in the base of the component. Could the author give some of his experiences with regard to low-carbon steel and say whether he could guarantee that there would not be a torn surface on the shaping of the billet. Many billets were produced that appeared to be satisfactory but it was not possible always to be sure that they were sound.

Dr. FELDMANN said that he had had no trouble. He had used cropping and pre-forming in mass production for three years in this country and had not had any such experience.

Mr. MORGAN said that it was possibly satisfactory for a union joint for a steam pipe, because the bottom was knocked out.. It might also be suitable for a wrist pin or gudgeon pin in a motor-car but when the bottom was knocked out of a high explosive shell it had to be perfect with no incipient cracks.

Dr. FELDMANN said that during the war all the shells were produced from cropped slugs which had given no trouble.

Mr. MORGAN asked whether this meant that he could, by the way in which the bar was fed down and the way in which the two cutting tools were applied, shear a billet without tearing ?

Dr. FELDMANN said that it did, but it was necessary to remember that the experience extended to 3 in. only.

Mr. DREWERY (English Steel Corporation) said that a film screened by Dr. Feldmann had shown a slug coming along and being indented, first about $\frac{1}{4}$ in., then another $\frac{3}{8}$ in. and then a further backward extrusion taking place. Why was it done in three steps ?

Dr. FELDMANN said that it was possible to do it in one step. He felt that three steps were better because the tool life was improved.

Dr. WALLACE (University of Sheffield) said his impression was that the same reduction was taking place each time, and that, therefore, the same loading was on the tools—though for a shorter period. He could not see the advantage of this.

Dr. FELDMANN reminded Dr. Wallace of the load-displacement diagram that had been shown, and added that the whole stroke was used for this sequence of operations, beginning with cropping and proceeding step by step.

Mr. MORGAN said he could see what Dr. Feldmann meant, and that it would probably give a fair degree of concentricity. It emphasized again a point that had been raised earlier, one in which everyone was interested, *i.e.* the concentricity of the hole with the outside diameter and the depth by extrusion which the author considered possible. He had heard that Versons could go as far as $6\frac{3}{4}$ times the diameter. He had never found that possible yet without the punch wandering, but he had only used high-speed-steel punches and not the carbide type. What was the author's experience with regard to the depth of hole that could be made in relation to the diameter ? If he felt able to undertake, say, five times the diameter, what concentricity could he hold to of the bar with the outside diameter ? What did he think was reasonable ?

Dr. FELDMANN said he thought 0.005 in. was reasonable, and that perhaps five times the diameter might be achieved, using steel punches.

Mr. F. WOODWARD (Padley and Venables Ltd.) asked whether there was a cold-forging machine which would offset bar stock as would a hot-forging machine. Only vertical presses had been referred to in the paper. Was there in existence a horizontal machine which, instead of merely forging from slugs, would offset bars ? All the emphasis

(*Continued in page* 582)

I.S.M.E. Discussion

(*Continued from page* 581)

seemed to have been on cropping slugs and not offset flanges on bars. He also asked about the pressures involved. He said that if to offset a 1¼-in. round with a hot machine it was possible to use a 200-ton type, but he did not know whether this was possible when offsetting from cold.

The CHAIRMAN asked whether Mr. Woodward was thinking of cold-forming the end of a 15-ft. bar.

Mr. F. WOODWARD said that he was and, to take it a stage further, could cold forming replace a drop stamp ?

Dr. FELDMANN said that it could.

Mr. MORGAN said that he did not think it would be possible because it was not possible to support the 15-ft. long bar while the end was knocked up.

Dr. FELDMANN said that it would have to be a special installation.

Mr. GRANBY felt that the pressures involved would be so high as to make it impossible. In theory it was possible to cold form anything but he wondered whether Mr. Woodward would be willing to pay for it.

Mr. WOODWARD said that he had asked whether it could be done. He had not considered the cost.

Mr. GRANBY said that cost was the first thing to be considered before investigating any process.

Mr. MCKENZIE (N.E.L.) said that, before starting upon research into cold extrusion of steel, a great many papers had been reviewed and of these Dr. Feldmann's had perhaps been the most valuable. Many things of importance and value had come to light, but he had found slight discrepancies in the determination of the load required to produce a certain object by his method of using the mean flow stress of the material and the efficiency of the process. He seemed to recall that Dr. Feldmann, in his book, had a curve showing a decrease in efficiency with increasing reduction. N.E.L. found that, in fact, the efficiency of the process increased with reduction.

Mr. HUNNISETT asked for comment on the use of the 126-deg. angle on a forward extrusion shoulder and the reasons behind the selection of that angle when the work done suggested that a much smaller included angle would be beneficial.

Dr. FELDMANN said that during the war he had used 27 deg. This had been a great secret and had come from the toolmakers. One of his first articles was to the effect that he found the minimum pressure obtained with 30 deg.

Mr. HUNNISETT said that this did not agree with the work done since, which suggested that the minimum pressure was obtained nearer 60 deg.

Mr. MCKENZIE said that 60 deg. was the included angle and comparable to the author's 120 deg. The papers published by Fischer and the author suggested an included angle of 126 deg. In fact. PERA had produced results during the conference which had shown the pressure going right down to 30-deg. included angle. Another worker's results showed minimum pressure at 30 deg. also.

Mr. PUGH said one thing that should be remembered was that though his results, and those of others, had suggested that the extrusion pressure did come down with the angle, and a minimum was obtained at 60 deg., the flow patterns gave the impression that on a sharp entry die there was a dead metal region whose angle did correspond to about 120 deg. But he still did not see why any particular angle such as 120 deg. rather than a low angle should be used.

Continuous Casting and Rolling

(*Continued from page* 572)

2:1 on a 20-in. drum diameter and gives very reasonable running times on the tandem mill where the second stand runs at a maximum speed of 900 ft. per min. The actual running time and rolling speed results in a very good loading factor of this mill. After adding a third stand to this tandem mill the loading figures will be even better.

Summary

The casting machines Mark III are available in four standard sizes:

Size 1.	For strip between	4 in. and 8 in. width
Size 2.	,, ,, ,,	8 in. and 12 in. ,,
Size 3.	,, ,, ,,	12 in. and 16 in. ,,
Size 4.	,, ,,	up to 20 in.

Naturally the bigger machines can be used to produce any narrower strip but for each width a separate casting wheel rim has to be used to ensure that the centre of the cast strip is in line with the centre of the rolling mill and so that the strip can be fed in a straight line over the carry-over bridge into the edging rolls and the rolling mill.

When determining the most suitable width of the line the potential user should carefully investigate his actual requirements as the capital expenditure rises very abruptly with increase in width and the corresponding need for larger sizes of mills. Furthermore the output of the wider lines in most cases exceeds by far the actual requirements, so that these lines cannot be operated on a fully continuous basis which naturally reduces the economy of such a line to a great extent. These lines, by reason of the extremely low metal conversion figures, are amortized in a very short time, sometimes even within one year, providing that they have been chosen correctly, and it is therefore a mistake to try and save installation costs by using old existing rolling mills as in such cases, generally, the running costs render the installation uneconomic.

A Note on the Use of

GLYCOLS AS SOLVENTS IN ZINC CHLORIDE SOLDERING FLUXES

By C. J. THWAITES, M.Sc., A.R.S.M., A.I.M*

THE use of polyethylene glycol instead of water as a solvent for the zinc chloride type of fluxes has been proposed by the Tin Research Institute ([1], [2], [3]) and offers as a principal advantage a means of avoiding the explosive boiling away of the water with the attendant spattering of corrosive liquid over regions adjacent to the soldered joint. There was some evidence from the preliminary tests that a glycol-based flux gave better wetting by the solder than did a normal aqueous flux solution. Further experimental work has now been carried out in order to assess more precisely the potentialities of polyethylene glycol and also of polypropylene glycol as solvents for zinc chloride.

Solder-Spread Tests

The fluxing properties of aqueous and glycol solutions were compared, by a spread-of-drop solderability test. The standard test for solderability used in the laboratories of the Tin Research Institute, involves electrical resistance heating of the specimen on which a pellet of solder and the flux are placed([4], [5]). When comparing different fluxes, the latent heat of vaporization of the flux solvent is of the same order as the heat required to raise the temperature of the specimen to the required level so that changing the composition or volume of the flux causes substantial changes in the input of power required to heat the test specimens. It was found to be difficult to balance these changes by adjustments to the power supply and the electrical resistance heating technique therefore was deemed to be unsuitable for the present purposes, although still ideally suited to comparing the solderability of surfaces or the quality of solders.

Tests were then carried out by Monsieur G. Gallon† in the Institute's laboratories in which a pellet of solder and the flux to be tested were placed on a small square test-piece of thin sheet which was then floated on the surface of a bath of molten solder maintained at the desired temperature. In this case, the heat capacity of the solder bath was large relative to the total heat required to raise the temperature of the specimen, volatilize the flux solvent and melt the solder pellet.

In the particular experiments described below, about 2 lb. of eutectic tin-lead solder was contained in a steel dish and was maintained at 300 $\pm$ 3°C on an electric hotplate. Blackplate sheets, of approximately 0.010 in. thickness, were used to make the test-pieces. To one face of the blackplate was applied a thin electroplated tin coating which was subsequently flow-brightened, by a technique described elsewhere([6]). The tinned face was used as the under surface of the specimens and ensured immediate wetting and rapid transfer of heat from the solder bath to the test-piece. It was found to be an additional advantage to coat the tinned face with a thin film of resin-alcohol solution, which was dried before the test was carried out, to remove oxide films and to aid the wetting.

Test-pieces were 0.625 in. square and the upper plain steel test surfaces were cleaned successively with 400 and 600 grades of emery paper and finally degreased by immersion in acetone. One corner of each specimen was turned up so that it could be lowered on to the solder bath with forceps.

The required volume of flux solution was placed in the centre of the test surface with a hypodermic syringe, each drop being 0.01 ml. 0.17-gm. pellets of 60 per cent tin-40 per cent lead solder, punched from 0.06-in. thick rolled sheet, were degreased in acetone and one was placed in the centre of the pool of flux on the specimen. After skimming the surface of the solder bath to remove any oxide, the test-piece was floated on the solder for 10 seconds. After removal and cooling, the specimen was washed free of flux residues, dried and the area of spread of solder was measured with a planimeter. Not less than three tests were made on any one flux composition.

A total of 24 tests were made with an aqueous solution containing 100 gm. per litre of zinc chloride and 5 ml. per litre of hydrochloric acid in order to check the reproducibility of the area of

*Assistant Chief Metallurgist, Tin Research Institute.
† Compagnie Française de l'Etain, Annecy, France.

spread of solder. The mean value obtained was 0.40 sq. cm. and 70 per cent of the individual areas were within ±0.05 sq. cm. of the mean indicating a satisfactory degree of reproducibility.

Flux solutions containing 100 gm. per litre of zinc chloride but with polyethylene glycol or polypropylene glycol (molecular weights of 200 and 400 respectively) as a solvent in place of water were tested and the results of varying the volume of flux used in the tests are shown in Table I.

TABLE I—*Area of Solder-Spread for 100 gm. per litre Zinc Chloride in Different Solvents*

Solvent	Area of Spread for Various Amounts of Flux			
	Trace*	0.01 ml.	0.03 ml.	0.06 ml.
Water	0.40	0.45	0.51	0.59
Polyethylene glycol 200	0.55	0.69	0.72	0.78
Polypropylene glycol 400	0.60	0.75	0.60	0.80

*Solder pellet dipped in the solution and the excess drained off for about one minute.

The glycols are rather viscous which might lead to an excessive consumption of flux on a production basis and the effect of diluting with water or isopropyl alcohol, to lower the viscosity, was therefore investigated. It was found that dilution with water caused no significant alteration in the solder-spread for additions of up to 20 per cent by volume of water, at which level spattering became severe. Also, the spread of solder obtained with polypropylene glycol diluted with isopropyl alcohol was practically independent of the solvent composition up to 70 per cent of alcohol. Dilution of a solution of zinc chloride in polyethylene glycol with isopropyl alcohol actually increased the area of spread of solder, an optimum being obtained in the region of 30 per cent by volume of alcohol. Table II compares the spread of solder using a flux of this composition with that obtained from the aqueous zinc chloride.

TABLE II—*Spread of Solder for Aqueous and Polyethylene Glycol-Isopropyl Alcohol Fluxes*

Solvent	Area of Spread for Various Amounts of Flux			
	Trace	0.01 ml.	0.03 ml.	0.06 ml.
100 gm per l. $ZnCl_2$ + 5 ml per l. HCl in water	0.40	0.45	0.51	0.59
100 gm per l. $ZnCl_2$ + 5 ml per l. HCl in 5 vol. polyethylene glycol 200 + 2 vol. isopropyl alcohol	0.54	0.55	0.80	1.1

For the smaller amounts of flux, dilution with alcohol apparently did not increase the spread of solder due probably to rapid evaporation of the alcohol from the small pool of flux prior to testing. Fig. 1 shows the results of some of these solder-spread tests.

Polyethylene glycols of molecular weight higher than 200 suffered from the disadvantage of high viscosity and were therefore not examined to any great extent. A solid type of molecular weight 4,000 dissolved in alcohol did not appear to offer any advantages over aqueous zinc chloride solutions.

It was observed that an aqueous solution always gave an irregular contour to the spreading solder whereas the glycol-based fluxes resulted in a smooth outline to the solder. However, the fluxes based on glycols not diluted with alcohol gave a slightly slower wetting and spreading of the solder.

Spattering Tests

For estimating the spattering properties of the flux solutions, L-shaped test-pieces of steel prepared and tinned on one face, as before, were used. These were 2.5 in. wide and the vertical limb was 3 in. high. The required amount of flux solution and a solder pellet were placed on the horizontal limb about 0.25 in. from the bend.

The panels were rested on supports in the solder bath so that the lower face of the horizontal limb just made contact with the surface of the molten solder. Rapid volatilization of low boiling-point solvents occurred immediately, causing a spray of corrosive liquid to fall partly on the vertical face of the test panels. After 10-seconds' heating, the panels were removed and placed in a closed vessel over water for 48 hours, to allow rusting to proceed where residues of zinc chloride were present.

Fig. 2 shows the pattern of rusting obtained with the use of the standard aqueous 100 gm. per litre zinc chloride. With only a trace of flux present, a perceptible spattering occurred, while with 0.06 ml. of solution, the test panel became nearly completely rust-covered after exposure to humidity. In Fig. 3 may be seen the results of spattering tests using polyethylene glycol as a solvent or this substance diluted with isopropyl alcohol in the proportions of 5 volumes glycol to 2 volumes of alcohol. This dilution, which had been shown earlier to give the optimum spread of solder, did not cause any significant spattering to occur even with the greatest quantity of flux that was tested.

Undiluted polypropylene glycol solutions caused no spattering, but in the dilution desirable to obtain a suitably low viscosity, namely 30 per cent glycol in isopropyl alcohol, considerable spattering occurred (Fig. 4), although still less extensive than obtained with an aqueous solution. It was observed during these experiments, that fluxes containing polypropylene glycol moved away from the source of heat and in fact climbed up the vertical face of the test panels, as may be seen in the photograph.

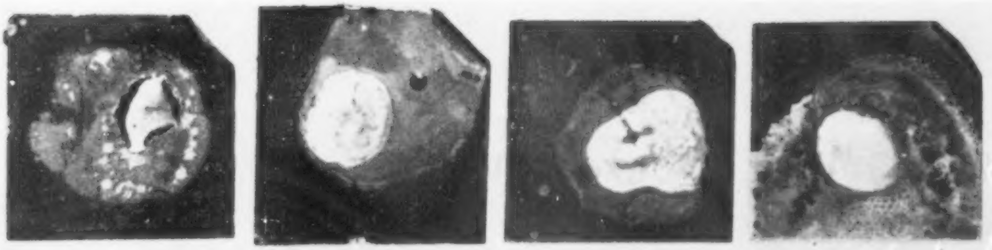


Fig. 1 (above).—Area of spread of 0.17 gm. of 60 per cent tin-40 per cent lead solder on clean steel using a flux containing 100 gm. per litre zinc chloride and 5 ml. per litre of hydrochloric acid dissolved in (from the left), water, polyethylene glycol 200, 70 per cent polyethylene glycol 200 + 30 per cent isopropyl alcohol, polypropylene glycol 400

Fig. 2 (below).—Rusting of steel panels after spattering tests with an aqueous 100 gm. per litre zinc chloride solution, using a trace, 0.01, 0.03 and 0.06 ml. of flux, respectively from the left

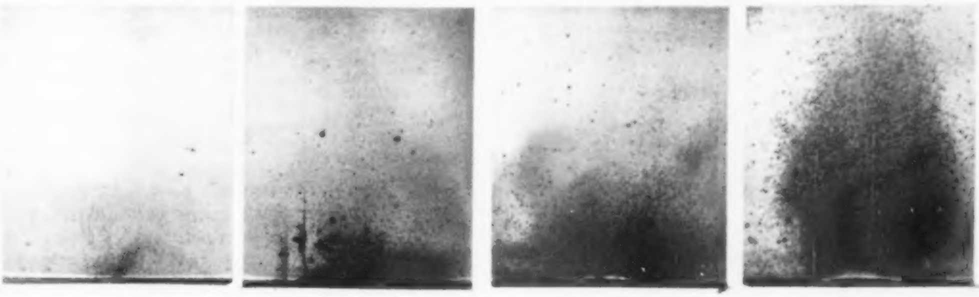
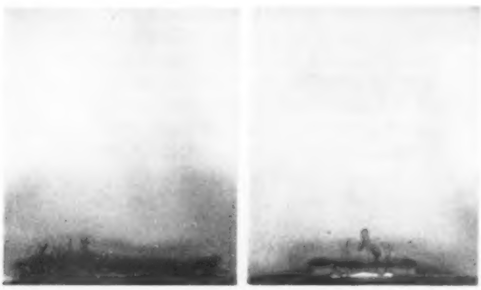


Fig. 3 (below).—Lack of spattering with solutions of 100 gm. per litre zinc chloride in polyethylene glycol 200 (left) or a mixture of 70 per cent of polyethylene glycol with 30 per cent isopropyl alcohol (right). 0.05 ml. of solution was used in these tests



As noted earlier increasing additions of water instead of alcohol to solutions of zinc chloride in either type of glycol caused significant spattering when more than 10 per cent by volume of water was present. Dilution with water was therefore considered to be of no practical interest.

Jointing Properties

To confirm the findings of the foregoing experiments, two L-shaped steel pieces were placed back to back and were soldered by passing a normal 60-watt electric soldering iron along the joints using a 60 per cent tin-40 per cent lead solder in the form of 0.06-in. square strips. The standard aqueous flux, the undiluted polyethylene and polypropylene glycol solutions and the flux based on a mixture of 5 parts polyethylene glycol with 2 parts isopropyl alcohol were applied in turn to the joint with a moistened camel-hair brush. The completed joints were rusted for 48 hours as in the spattering tests.

Fig. 5 shows the resulting appearance of the test-pieces. Widespread rusting of the joint made

Fig. 4.—Significant spattering and "creep" of the flux using 100 gm. per litre of zinc chloride dissolved in a 30 per cent polypropylene glycol 400 + 70 per cent isopropyl alcohol solution. Undiluted polypropylene glycol 400 gave no spattering but the "creep" was still severe and the fluxing action was relatively poor

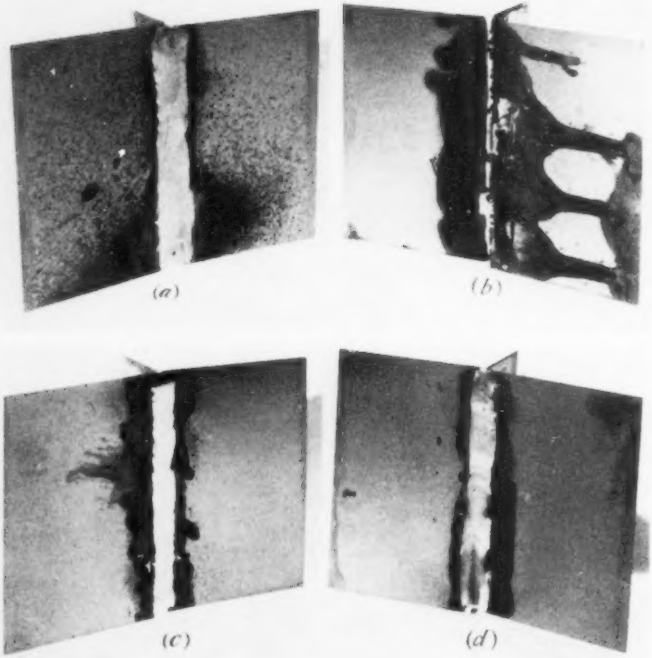


Fig. 5.—Laboratory-made joints after being subjected to 48-hours' rusting treatment. The flux solvents employed were (a) water, (b) polypropylene glycol 400, (c) polyethylene glycol 200, and (d) 70 per cent polyethylene glycol 200 + 30 per cent isopropyl alcohol. The appearance of the joints made with aqueous and polyethylene glycol + alcohol solutions are comparable but the latter has given rise to no spattering and consequent general rusting

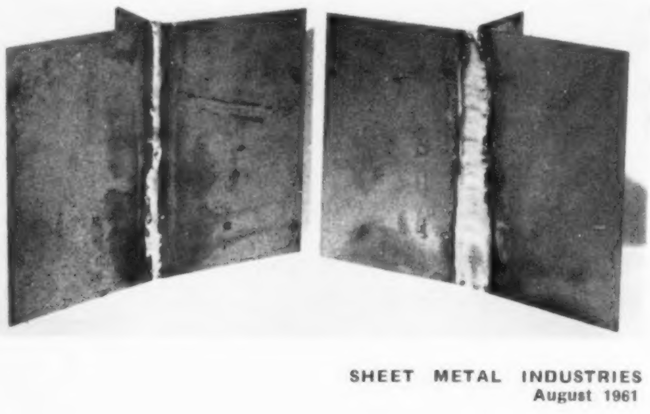
with an aqueous flux had occurred, due to the spattering, but those made with fluxes containing polyethylene glycol remained relatively uncorroded. As soon as the soldering iron was applied with the polypropylene glycol fluxes, the flux spread far from the joint leaving insufficient to enable a satisfactory joint to be made. The overall dispersion of the flux caused considerable general rusting to occur. This behaviour confirmed the observations made on this type of flux during the spattering tests.

With regard to the ease of making the soldered joint and final appearance of the seam, the aqueous zinc chloride was classed as the best but the polyethylene glycol-isopropyl alcohol mixture was only slightly inferior and produced a joint of good appearance. The undiluted polyethylene glycol solution was less efficient and it was more difficult to produce a smooth surface on the solder. With the polypropylene glycol flux, as mentioned above, it was not possible to make a satisfactory joint.

These trials were repeated on steel panels that were initially coated with a thin film of lubricating oil. In this case, an unsatisfactory joint was made with the aqueous flux solution whereas the fluxes containing polyethylene glycol behaved just as well as when no oil was present. The final appearance of two of these joints is shown in Fig. 6. The addition of wetting agent and alcohol to the aqueous zinc chloride naturally improved the behaviour of this flux under these conditions but it was still inferior to the glycol-based solution.

It is well known that residues of fused zinc

Fig. 6.—Difference in the quality of laboratory-made joints with oil-covered steel sheet, using a zinc chloride solution in water (left) and in polyethylene glycol 200 + isopropyl alcohol (right)



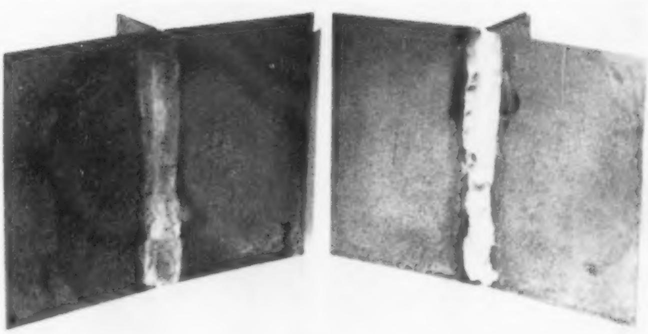


Fig. 7.—Rust staining, after 48-hours exposure to humidity, of a joint made in the laboratory, using aqueous zinc chloride, washed and dried prior to exposure (left). Using the polyethylene glycol 200 + isopropyl alcohol solution, the flux residues were more easily washed away and less rusting has occurred during exposure (right)

chloride fluxes are difficult to remove completely since contact with water causes hydrolysis and the chloride particles become coated with an insoluble gelatinous film. It was felt that since the glycol type of flux does not become dry during the making of a soldered joint, and this substance is readily soluble in water it was likely that the residues from this type of flux might well be more easily removed and cause less corrosion subsequently. Some of the experimental soldered joints were therefore briefly washed in running water before being dried and subjected to rusting tests. Fig. 7 shows two of the panels, the one on the left having been soldered with aqueous zinc chloride and the one on the right with the polyethylene glycol-isopropyl alcohol flux solution. The smaller amount of general rusting that has occurred with the glycol-based acid flux is apparent.

Some of the experiments were repeated using a higher zinc chloride concentration, namely 400 gm. per litre. The ease of soldering was considerably improved in all cases and the aqueous solution was then only marginally superior to that based on a polyethylene glycol-isopropyl alcohol mixture. Spattering was very much worse with the aqueous zinc chloride, however, but only slight spattering was evident from the glycol flux. Additions of alcohol and rather large quantities of wetting agent (0.5 per cent of Teepol), which are both reputed to reduce spattering, did in fact reduce somewhat the rusting obtained with the aqueous flux but the corrosion was still far more extensive than that occuring with the same concentration of zinc chloride in a glycol-alcohol solution.

It was found also that an addition of 0.5 per cent of wetting agent to the polyethylene glycol-isopropyl alcohol flux solution appeared to be beneficial in producing a soldered joint of slightly better appearance although the fluxing behaviour of the solution remained unaltered.

Summary

It may be concluded from the results of these experiments that polyethylene glycol of molecular weight 200 is a satisfactory solvent for zinc chloride in the presence of a trace of hydrochloric acid or other chloride. Dilution of the glycol with isopropyl alcohol in the approximate proportion of five volumes of glycol with two of alcohol gives an enhanced efficiency as a flux and a less viscous solution, thus reducing wastage. Although fluxing action is slightly slower than that of an aqueous solution and the final appearance of the joint may be perhaps a little inferior, no spattering of the flux occurs, thus limiting corrosion or staining of regions adjacent to the joint and avoiding the possibility of harmful effects on the hands and face of the operative. These factors may be of considerable significance in some applications. The solvent produces only a little fume when it comes into contact with the soldering iron and the resultant odour is not unpleasant. An added advantage appears to be the ability of the flux to act satisfactorily when substantial quantities of oil are present, which would normally make soldering rather difficult using aqueous fluxes. There is some evidence that residues from a glycol-based flux are more easily washed away by a simple rinse with water although if undiluted polyethylene glycol is the solvent, some charring occurs during soldering and these residues while apparently not harmful, may be a little more difficult to remove.

While recognizing the increased cost involved with solutions of zinc chloride in polyethylene glycol, the principal advantage of lack of spattering during soldering may justify, in certain instances, a works trial and as a basis for such a trial it is tentatively suggested that the following composition may be employed for soldering plain steel :

Zinc chloride	250 gm.
Polyethylene glycol 200	700 ml.
Isopropyl alcohol	300 ml.
Hydrochloric acid (S.G. 1.16)	5 ml.
Wetting agent (Teepol)	5 ml.

(*Continued in page* 594)

Feeding Band and Strip Material to Automatic Presses

By A. P. J. SOEPNEL

Introduction

THE enormous number of components required for radio, television and domestic apparatus for example, are for a considerable part manufactured with the aid of automatic presses. The hourly production per man and per machine can be a multiple of that of a non-continuously operating press. Further, with automatic presses the safety of the operator is much greater while fatigue hardly comes into the picture. It is even possible for one operator to control more than one press.

The r.p.m. of these presses are adjustable and dependent on the tool used, form of product, accuracy, type of operation and type of material being worked. The material of which the components are to be made is, if possible, fed periodically, in band form, to the tool. Where, after having made the desired product with the tool assembled in the press, a piece of scrap remains, then it is desirable, especially where thin material is concerned, to feed this out also in order to prevent it from clogging up the expensive and vulnerable tool.

A good material feed and ejection device must fulfil the following requirements :

(1) Adequate accuracy of the fed material length must be guaranteed. This accuracy must be maintained for longer transported lengths and higher feed rates.

(2) Both accuracy and feed rate must be capable of adaption to small, large, high and low tools.

The importance of an accurately fed length of material should be evident from the following :

Very often, in order to prevent inaccuracies in the transported length from causing damage, the tool used is provided with pilot pins. These latter will engage, after each material transport, in holes in the material made for the purpose by the tool. Since these pilot pins are tapered they will engage with a hole which is not quite in the correct position, without causing any damage, and at the same time line up the material properly before the actual operations with the tool begin. Again contact pins can be used, to cover the case where excessive misalignment of the strip results in the pin hitting the material instead of engaging with a hole. In such an eventuality a contact is then closed which operates the clutch and brake of the press, *via* a relay, causing it to be stopped before great damage is caused. It is clear that, disregarding the complication which a safety measure of this nature introduces, strips of material are often necessary which are much wider than is the case where pilot holes are omitted and the costs of tool and material required are then higher. Furthermore, where pilot holes are made in very thin material the pins may deform them or even cause them to tear. If it was possible to do away with pilot holes and to be sure, at all times, of obtaining an accurate transported length, then less scrap and cheaper tools would result.

Existing Types of Feed

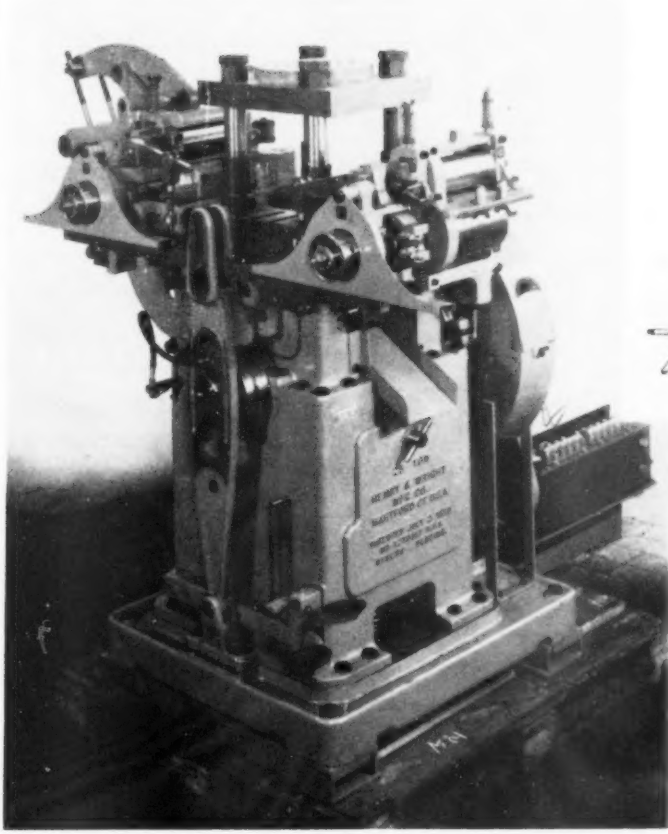
The material transport apparatus obtainable in the trade can be divided into two groups, *viz.:*

(a) Roller transport (Fig. 1).

(b) Clamp transport (Fig. 2).

In both types, the motion for the material transport is derived from the main shaft of the press and sometimes from the ram. In a roller transport the rollers revolve periodically in one direction. At the end of the transporting motion, the rollers usually have the load momentarily removed in order to allow the pilot pins to line up the then free material.

In the clamp transport there is a reciprocating slide carrying a clamping mechanism which grips the material during the transporting motion and opens for the return. Usually some sort of braking or clamping device makes sure that the material is not pushed back during the return of the slide. Both types of transport device can be supplied solely for material feed, thus on one side of the press only, or, again, for both feed and ejection, in which case one is mounted upon each side of the press.



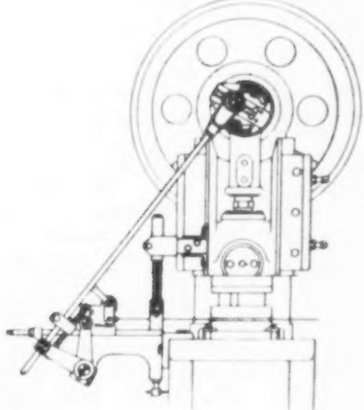


Fig. 1 (left).—Roller transport

Fig. 2 (above).—Clamp transport

Accuracy

For high-speed presses (200 to 800 r.p.m.) it is possible to obtain an accuracy of anywhere between about 0.05 to several millimetres in the material feed. These large differences are not solely attributable to the type of transport apparatus since play in the bearings and transmission can considerably influence the required accuracy. It is understandable that a strip of material in motion is not going to stop instantaneously and will, in fact, tend to carry on further, the extent to which it does so being dependent upon weight, velocity and the friction to be overcome; in this connexion it is necessary to bear in mind that there is line contact between material and rollers. In a roller transport, the rollers too will tend to revolve further and a brake is usually called in to curb this effect.

Dependent upon the fed length, the feed-rate is usually around 10 to 30 metres per min. (30 to 90 ft. per min.). This rate is dependent upon the required accuracy and one should bear in mind the weight of the material as well, of course, as the nature of the operations and the tool employed. With a clamp transport, the slide can be made to move between stops.

The manner and instant of opening and closing the clamp are of particular importance here while an additional clamp for holding the material during the return of the slide is very important. The requirement made under (2), namely, ease of adjustment and adaptability to tools of different dimensions, will now be further examined.

(a) Roller transport.

The distance between a pair of rollers and the bedplate is not adjustable. Hence it can be too small for a large tool yet, in the case of a small one, the band of material must often be supported and led to and from the tool. This means that sheet-iron channelling or expensive guides have to be employed without any reduction in the chance of clogging and no guarantee at all that the accuracy will be maintained. Many roller-feed devices are adjustable in the vertical plane.

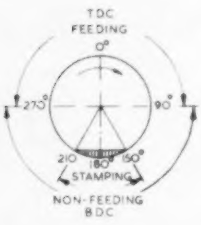
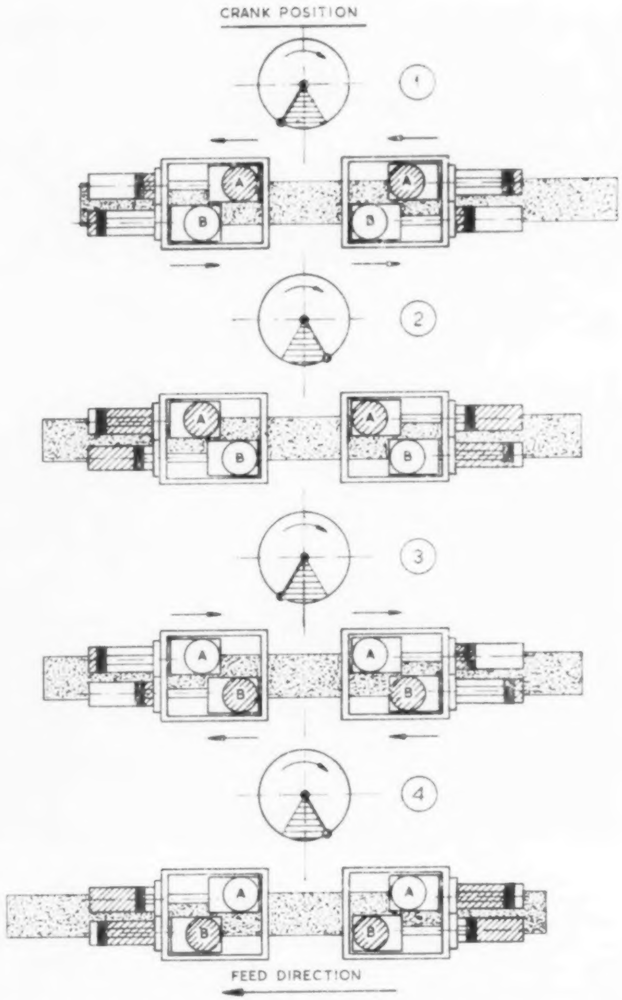


Fig. 3 (above).—Crank diagram

Fig. 4 (right).—Diagram of twin-slide feed



(*b*) *Clamp transport.*

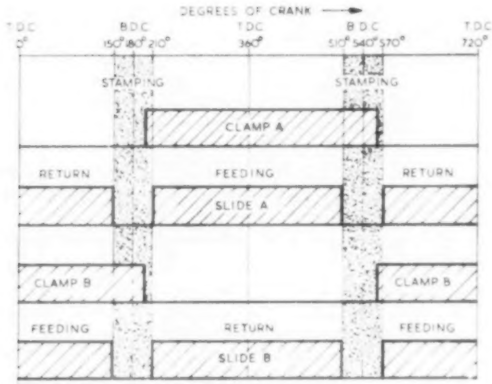
The same remarks apply here as for the roller transport although a few types do have limited horizontal adjustment.

From the foregoing, it should have become apparent that the accuracy depends, among other things, upon the transport velocity. The material transport devices discussed, insofar as they are driven from the main shaft of the press, can use but a part of a shaft revolution for the transport motion. From the driven system it follows that feed and ejection are symmetrical, *i.e.* that there is a maximum of 180 deg. available for feed and 180 deg. for return.

However, dependent upon the ram stroke, the material thickness and the form of the product, the material feed will often have to be terminated at about 30 to 40 deg. after this point. The time diagram upon which above mentioned transport motion is based is represented in Fig. 3. With the aid of a specific construction, the feed arc can even be made somewhat greater than 180 deg., the return arc being reduced by this (expressed in degrees) can be obtained if use is made of a grooved disc or cam disc, or, again, if the command for feed and return is given by, for example, cams on the main shaft operating electrical switches or pneumatic valves by means of which the correct motions are started and terminated at the proper instant. However, grooved discs or cammed discs usually result in a more complicated mechanism due to the fact that a specific degree of adjustment in fed length must be catered for. It then becomes difficult to obtain the required accuracy due to the influence of play in the many bearings. The use of a brake to curb the influence of play must not be regarded as a solution.

New Feed Design

The most important properties of an improved construction should be :



(1) Horizontally adjustable.

(2) Vertically adjustable.

(3) Suitable for both feed and ejection of the material.

(4) Accurate feed at low and high press speeds.

(5) Accurate feed with short and long fed lengths.

(6) Can be mounted cheaply on any press.

Since the properties mentioned under 1, 2 and 3 are obvious from the figures we shall proceed to examine those mentioned in 4 and 5 more closely.

Operation

The apparatus employs two material clamps such that while one clamp is transporting the material, the other is returning in the opened position. Since, in the following stroke, the latter clamp grips the material and transports it while the first-mentioned clamp simultaneously returns in the opened position, there is absolutely no time wasted on the return stroke as was the case with the apparatus (roller type and clamp type) used up to the present.

We can hence count on $360 - 2 \times 30$ deg. $= 300$ deg. being available for material transport. This time is about 70 per cent longer than usual. This means that, compared with the known transport apparatus, the permissible velocity is so much higher or, if to be desired, that at a higher or similar velocity a higher accuracy can be obtained. The transport clamps move between positive stops which are easily and accurately adjustable by hand. Compressed air is used for both material clamps and for the feed and return motions.

The motions are reproduced in Fig. 4, in four phases, together with the associated crank positions. The cross-hatched spaces indicate which members are subjected to pressure.

Phase 1. End of stamping operations. The clamps A close, the slides A start transporting and the slides B return with clamps open.

Phase 2. End of slide motion—the feed stroke is thus terminated and stamping can now begin. The clamps A continue to grip the material until after stamping. The clamps can now also be freed for the purpose of any alignment necessary.

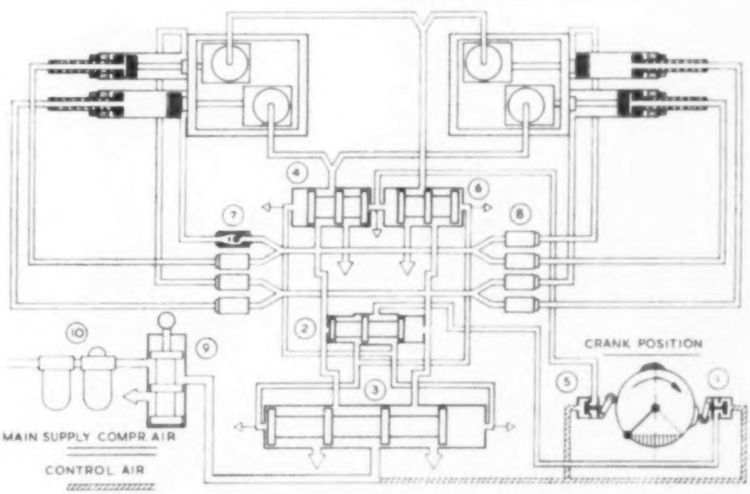
Phase 3. End of stamping. The clamps A open, the clamps B close, slides B start feeding and the slides A return.

Phase 4. End of slide motions. Stamping can now commence. The slide A is now again ready to commence feeding as in phase 1.

In Fig. 5, this operation is set out linearly over two press strokes. Since the drive is not mechanically coupled to the press, the motion can be con-

Fig. 5 (above).—Time sequence diagram—twin-slide transport

Fig 6 (right).—Diagram of pneumatic operation



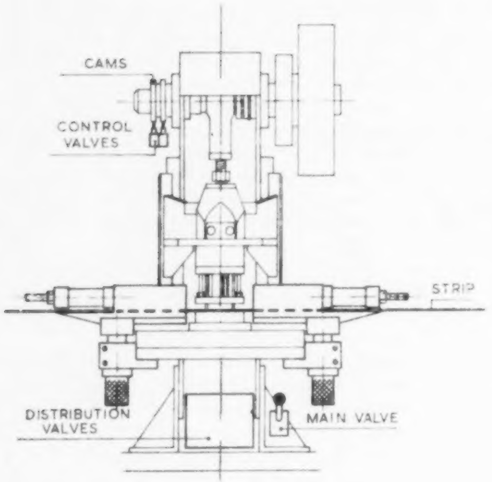


Fig. 7.—Press with strip transport device

trolled at any arbitrary instant. This adjustment is necessary since the apparatus must be mounted upon an eccentric press where the ram can lead or lag the crank-shaft motion according to the degree of eccentricity. This adjustment is also necessary where the operation time amounts to 60 deg. of crank or more as may be the case in drawing or bending operations. Naturally enough, the transport time is then shorter but is quite sufficient since such operations cannot usually be performed at high speeds.

Since the driving medium is compressed air and there is hence no mechanical coupling with the press, the motions can be arbitrarily controlled at all times.

This is achieved by means of an adjustable cam on the crank-shaft. (*See* Fig. 6). This adjustment is necessary since the apparatus is intended to be mounted upon an eccentric press and therefore, because of the adjustment of the eccentricity, the ram is angularly displaced with respect to the crank-shaft. Again, this adjustment is necessary where the working strokes requires more than 60 deg. of crank angle such as may be the case in drawing and bending operations.

The crankshaft also carries a small cam for the purpose of freeing the material clamps in the event that pilot pins are used in the tool and for cases where the material must be able to slide forward, *i.e.* in drawing and forming through bosses, etc. The two small cams upon the crank-shaft operate control valves which in turn actuate the distribution valves. These distribution valves, mounted in a housing, can be fixed to a central point on the press. The feed apparatus can be switched on and off by means of a main valve, even when the press continues to operate. (*See* Fig. 7.)

Hence, without stopping the press, it is possible to feed strips through one after another. At the same time, this constitutes a safeguard whereby in high-speed presses with a rolling-key clutch, the transport motion immediately can be halted.

Presses having a single-stroke clutch cannot generally be uncoupled immediately but must first lose some speed.

With large presses, between 60 to 200 tons, some of the air lines become so long that back pressures and rarification at high speeds can cause delays.

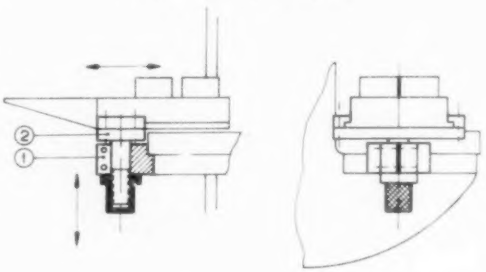
In this respect, electromagnetically-operated pneumatic valves have proved satisfactory.

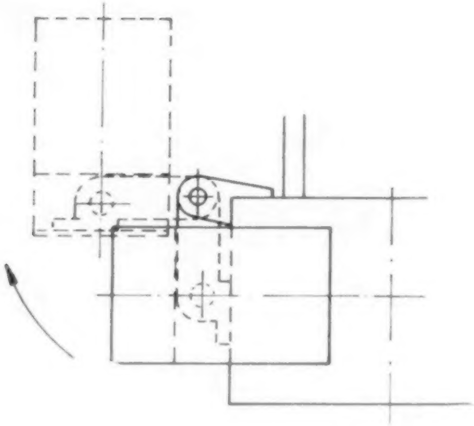
The air consumption of the complete apparatus is about 1.53 cu.m. per hr. at a speed of 250 strokes per min.

Construction and Design

Fig. 8 shows the attachment of the apparatus to the bedplate of the press. The apparatus can simply be adjusted to the material height by screwing the table (2) either up or down in the blocks (1). The apparatus itself is horizontally adjustable in its mountings on the table. With large presses, which must also be capable of manual operation, the block (1) can take the form of an arm so that the feed apparatus can be swung right away from the working space (Fig. 9). The apparatus is designed as a tray in which the two slides move adjacent to each other along guide rods. The slides each clamp the strip over half its width. Each slide is moved by an air cylinder which is mounted on the wall of the tray (*see* Fig. 10). The pistons in these cylinders each move from stop to stop. The stop facing the tool is fixed and is placed as near to the tool as possible; in this way the length subject to a sagging moment is kept to a minimum. The stop facing away from the tool is adjustable and takes the form of a piston to which the air connexion is fixed. Should the transport apparatus not need to move through the maximum stroke, adjustment of this piston maintains the waste volume in the cylinder constant; by so doing, the air consumption at short

Fig. 8.—Fixing to bedplate





strokes is reduced and yet rapid operation is possible.

The stop piston can be precisely adjusted by means of the bolt provided. The strip or band material is led through the apparatus between guides. These latter feed the material accurately between the clamps of the right-hand apparatus and immediately after the tool, between those of the left-hand apparatus. This feeding of the material between guides assures that, even with an obliquely set up press, no trouble is experienced. Just before and just after the tool, the material is passed into funnels. This enables the material to be lined up properly relative to the tool. Where highly polished or soft materials are being handled, clamping marks may appear. By virtue of the fact that the apparatus can be horizontally adjusted, it is possible to make sure that the clamps grip at points such that the marks will not show on finished products.

Accuracy

With the twin-slide apparatus described, a large number of tests have been made of the transport accuracy. The values obtained are reproduced in the graph (*see* Fig. 11). From this it appears that the accuracy decreases as the transported length and the number of strokes increase. This phenomenon is to be observed in nearly every transport apparatus. The number of strokes being constant, the accuracy decreases with increasing transported length due to the fact that the distance from the clamp to the tool becomes larger. The chance of a thin material sagging or cracking is increased. The accuracy of a roller-feed mechanism, mechanically driven by means of a cam clutch, is represented in Fig. 12.

It is recommended for increased accuracy, that the material supply reel be periodically rotated so that the material is transported smoothly. Also, in many cases a driven straightening apparatus can be useful since the result of accurate feeding is then not spoilt by bent resilient material being flattened and hence displaced by the tool.

Summing up, we can list the following advantages with respect to the usual type of apparatus :

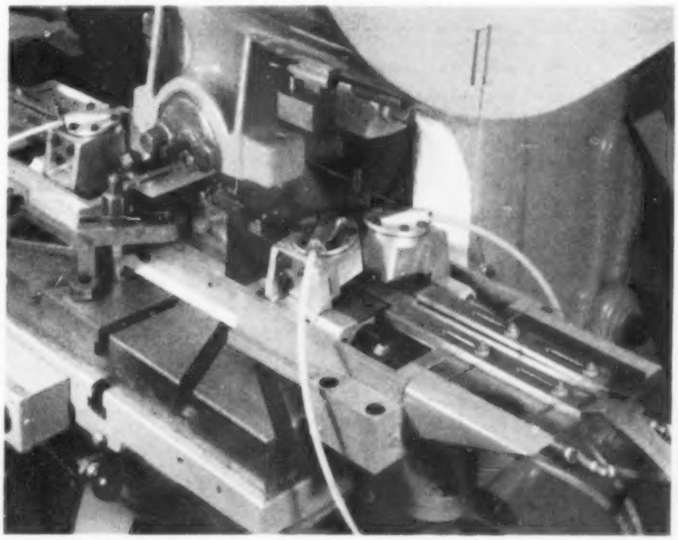
(1) Considerably better transport accuracy, especially at high speeds. In many cases the pilot pins can be omitted. The use of pilot pins for very accurate work is nevertheless possible.

(2) Not only simple tools but also progressive dies and compound tools can be successfully applied.

(*Continued in page* 594)

Fig. 9 (above).—Apparatus swung away

Fig. 10 (right).—Feed device mounted on press



Feeding Band and Strip Material to Automatic Presses

(*Continued from page* 593)

(3) It can be mounted as a universal apparatus on, for example, a modern, obliquely adjustable eccentric press. A press of this type is cheaper than other automatic presses.

Sometimes more operations are necessary, for example, compound stamping. After the feed apparatus has been slid or swung away, the press can be used for jobs set up by hand. In certain industries and with large presses of 70 to 200 tons, this can be of considerable importance.

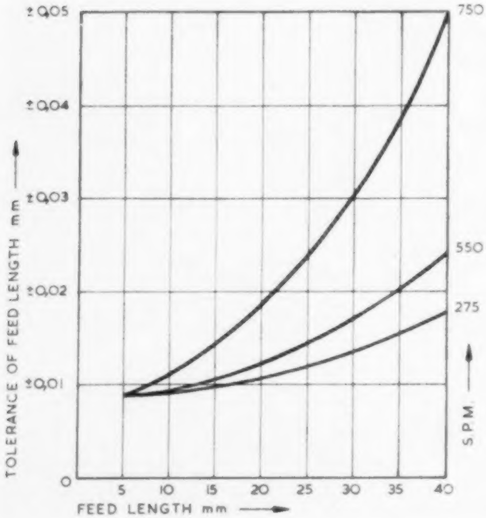
(4) Because of the universal adaptability of the apparatus, it is possible to feed fairly flexible material directly and automatically through into the tensioning apparatus without having to resort to special aids such as channels, supports, etc.

(5) The double-sided design makes it suitable for working strip material right to the end.

(6) The transport and pilot controls can be accurately adjusted for any job. Since the drive is independent of the press, the feed stroke is always completed by the time that the press is uncoupled at T.D.C.

(7) The twin-slide design makes it possible to work alternatively with a large or small feed stroke. By this means, it is possible to punch two holes at a specific centre distance or to alternatively make long or short products.

Fig. 11.—*Accuracy of twin-slide transport*



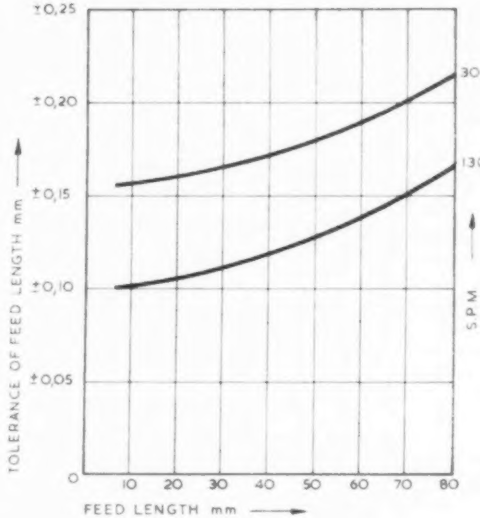


Fig. 12.—*Accuracy of roller transport device*

A Note on the Use of Glycols as Solvents in Zinc Chloride Soldering Fluxes

(*Continued from page* 587)

For tinplate or non-ferrous material, the zinc chloride content need not exceed 100 gm.

Since no water is present to cause hydrolysis of the zinc chloride, the addition of hydrochloric acid is not essential but the presence of other salts such as sodium, potassium or ammonium chlorides may be advantageous and worthy of trial.

Acknowledgements

The author is indebted to the International Tin Research Council for permission to publish this paper and wishes to acknowledge the valuable work carried out by Monsieur Gallon of the Compagnie Française de l'Etain.

References

1. Lewis, W. R., *Tin and its Uses*, 1959, (47), p. 3.
2. Lewis, W. R., *Tin and its Uses*, 1959 (48), p. 5.
3. Lewis, W. R., *Tin and its Uses*, 1961, (51), p. 14.
4. Thwaites, C. J., *Trans. Inst. Metal Finishing*, 1959, **36**, p. 203.
5. Thwaites, C. J., *Electrical Manufacturer*, 1960, **5** (8), p. 6.
6. Mills, R. and Thwaites, C. J., *Sheet Metal Industries*, 1954, **31** (329), p. 733.

STRAIN-AGEING of Mild-Steel Flat-Rolled Products*

By W. J. S. ROBERTS, B.Sc., F.I.M.†

Introduction

THIS paper does not attempt a comprehensive survey of the subject of ageing. For example it excludes quench age-hardening and no attempt is made to deal with the matter from the historical angle. The main concern is with describing, in simple terms, what strain-ageing is and how it effects the day-to-day operations of tinplate and sheet manufacture by the cold reduced process. The principles of strain-ageing applied in precisely the same way in the case of normalized sheets and packed rolled tinplate, but in the latter the difficulties associated with a pronounced yield elongation were absent because of the large grain-size. Many theories have been advanced to explain why strain-ageing should occur, but only the most recent one is dealt with.

The Effect

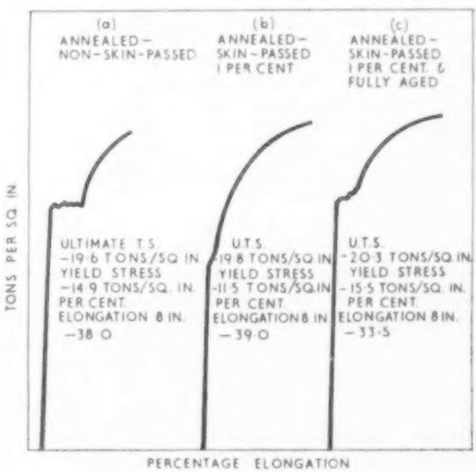
The phenomenon may be best described by taking a specific example. Suppose we start off with a 20-gauge extra-deep-drawing mild-steel sheet in the annealed condition and perform a tensile test. The initial portion of the stress strain diagram is shown in curve (*a*) Fig. 1 and the mechanical tests are given below the curve. The other curves in this diagram are also only initial portions of the full curve and have the corresponding mechanical properties entered beneath them.

It will be observed that there is a marked yield point and yield-point elongation. If this material is now extended 1 per cent by cold rolling, the yield point disappears and there is no yield extension. This is shown in the curve (*b*), Fig. 1. The limit of proportionality, however, has decreased and the ultimate tensile strength has slightly increased.

If the cold-rolled sheet is now heated for twenty seconds at 350° C. and a tensile test again performed, the curve (*c*) in Fig. 1 is obtained. It will be observed that: the yield point and yield extension have returned; the yield stress is higher than it is in the annealed condition; there is a further increase in the ultimate strength, and the ductility as measured by the total elongation has decreased.

This phenomenon is known as strain-ageing. It is a very serious matter in the manufacture and use of flat rolled products and could only be completely eliminated by the use of expensive non-ageing steels. Except where these steels are used, all hot-dipped tinplate is in the fully aged condition and electrolytic plate is substantially aged. The deterioration in properties resulting from this effect has to be allowed for in specifying steel grades and processing conditions. Similarly, with cold-reduced sheets made from normal rimming steel, ageing takes place with the lapse of time and the sooner the material is pressed after skin passing, the less the effect will militate against satisfactory results.

Fig. 1.—Initial portion of tensile stress/strain curves for 209 extra deep drawing sheet



*A paper presented to The South Wales Institute of Engineers.
†Steel Co. of Wales Ltd. (Tinplate Division).

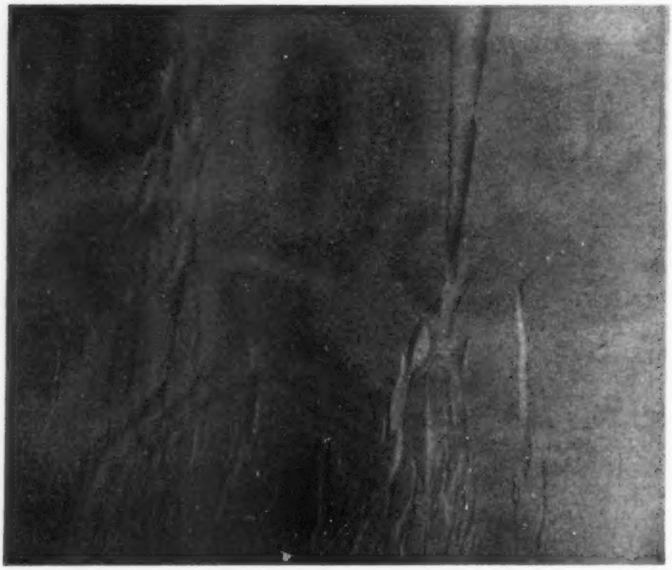


Fig. 2.—Stretcher-strains in annealed sheet

An additional effect of strain-ageing is the return of fluting and stretcher-straining after cold rolling. These effects are manifestations of the same thing, and are probably too well known to need much description. If an annealed piece of blackplate is stretched or drawn until the yield point is exceeded, a characteristic series of very shallow narrow grooves appear on the surface. In the trade these are referred to as stretcher strains and are shown in Fig. 2. In the tensile test they disappear well before the yield elongation is exceeded.

Similarly, if the plate is bent into a circle over a mandrel, instead of a smooth cylindrical surface being produced, a series of flats results. This is called fluting. Both phenomena only occur when the material has a marked yield point. With the elimination of the yield point by temper rolling, stretcher-straining and fluting are suppressed. Strain-ageing causes the return of the yield elongation and unless the amount of temper rolling has been large, these objectionable features of the annealed sheet recur.

Occurrence

A few unusual non-ferrous alloys have been reported as exhibiting a small yield point in the annealed condition. Slight increases in hardness and ultimate strength but no loss of ductility can be produced by ageing certain alloys of copper and of aluminium. But broadly speaking, the phenomena of the yield point and strain-ageing are almost entirely confined to mild steels. It is most pronounced in low-carbon steels and diminishes in steels made to a higher carbon content. Its effect is negligible in steels above 0.35 per cent carbon. The yield point elongation itself disappears at about 0.70 per cent carbon.

Measurement

All the mechanical properties which are affected by strain-ageing have been used as an index of it, with the increase being expressed absolutely, or as a percentage of the original value. There have also been some unusual methods proposed such as doing a Rockwell hardness test on the aged sample in the depression caused by a previous Brinell test. In sheet works practice, a method frequently adopted, particularly with regard to non-ageing steels, is that of Gensamer and Low[1]. In this method the material, in the form of a tensile test piece, is extended 10 per cent in a tensile machine. The specimen is then removed and artificially aged. The original recommendation was three hours at 200° C., but the general practice now is two hours at 100° C. or 10 minutes at 145° C., which gives an amount of ageing sufficiently near the maximum for all practical purposes, and is equivalent to about six months at room temperature. The test-piece is then re-tested and the percentage increase in stress for 10 per cent extension that has occurred during ageing is considered to be the strain-ageing index of the sheet.

The type of diagram obtained is illustrated in Fig. 3. The strain-ageing is $\frac{a}{b} \times 100$ per cent.

In tinplate practice, tensile tests are rarely carried

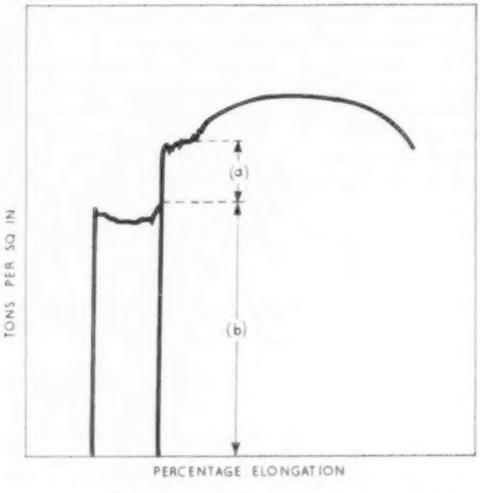


Fig. 3.—The Gensamer and Low strain-ageing index

out and the strain-ageing index of the material is taken as the difference in Rockwell 30T hardness value obtained after temper rolling and after tinning. The strain-ageing propensity of a particular specimen is no doubt a fundamental property of that specimen but it has to be measured by its effect on mechanical properties. Unfortunately even if a single mechanical property, say increase in ultimate strength, is used to measure the age hardening propensity of a number of supposedly identical samples a considerable spread in results is obtained. Further, if other mechanical properties are also used, the line-up between them is not always the same. For instance, in the case of two supposedly identical samples A and B, the increase in the ultimate strength of A may be greater than that of B, but the reduction in the total elongation may be lower.

Time/Temperature

As a result of internal changes taking place in the steel, which are not amenable to direct observation and whose nature is, of course, the main consideration of the various theories that have been put forward, the ageing effect commences as soon as the cold work is completed and proceeds at a rate dependent upon the temperature. The rate of ageing decreases with time, as shown in Fig. 4 where the increase of elastic unit with time is plotted for various temperatures.

These curves become very approximately a straight line when the log. of the time is plotted. This is shown in a diagram in a paper by Hundy[2] from which Fig. 4 has been derived. There is the proviso, however, that a state of maximum ageing is eventually reached for all temperatures and near that point the curves bend over relatively sharply to the horizontal.

It is evident from Fig. 4 that the rate of ageing increases rapidly with temperature. This relationship is given graphical expression in Fig. 5. Here the amount of ageing occuring at four fixed times has been plotted against the temperature. The data are the same as that from which Fig. 4 was plotted. Table I also, taken from this paper by Hundy gives the relationship between time and temperature in another form. The times required for a given amount of ageing at various temperatures are shown on the same horizontal line.

TABLE I

Equivalent ageing times at room temperature and at elevated temperatures.

15° C.	21° C.	100° C.	120° C.	150° C.
1 year	6 months	4hr.	1 hrs.	10 min.
6 months	3 months	2 hr.	30 min.	5 min.
3 months	6 weeks	1 hr.	15 min.	2½ min.
1 month	2 weeks	20 min.	5 min.	
1 week	4 days	5 min.		
3 days	36 hr.	2 min.		

The relationship between time and temperature has been worked out theoretically by Cottrell[3], on the basis of the dislocation theory, *viz.:*

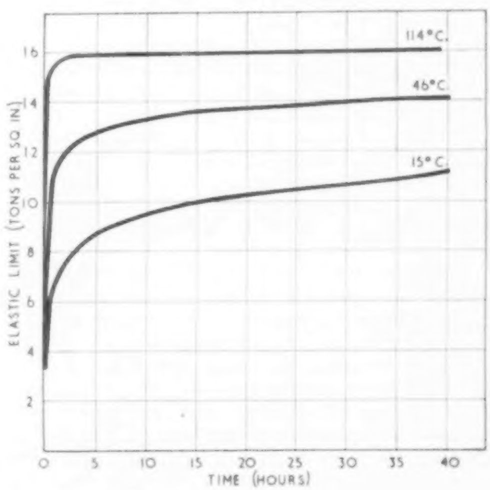
$$\log_{10}\frac{t_r}{t} = 4400\left(\frac{1}{T_r} - \frac{1}{T}\right) - \log_{10}\frac{T}{T_r}$$

assuming that carbon causes strain ageing, and

$$\log_{10}\frac{t_r}{t} = 4000\left(\frac{1}{T_r} - \frac{1}{T}\right) - \log_{10}\frac{T}{T_r}$$

assuming that nitrogen causes strain-ageing, where t_r is the strain-ageing time at room temperature T_r, and t is the time giving a similar degree of ageing at an elevated temperature T, the temperatures being expressed in °K. These formulae agree quite well with values obtained experimentally.

Fig. 4.—Effect of ageing at various temperatures on the elastic limit of temper–rolled mild steel



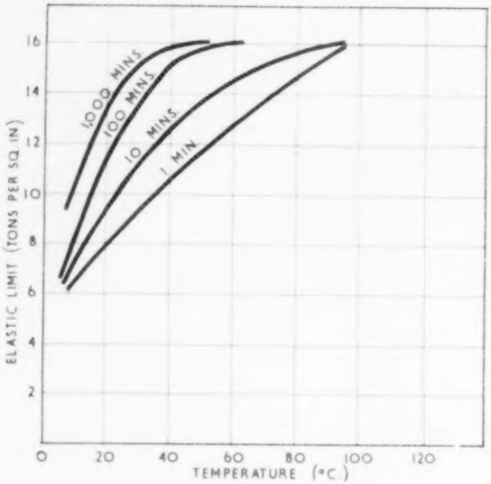


Fig. 5.—Effect of temperature on strain-ageing

The Degree of Straining

It has been seen how strain-ageing proceeds and how the rate at which it does so is affected by temperature. Ageing sets in as soon as the material is cold worked and shows up immediately on all the physical properties used to measure it except the return of the yield elongation. The period of time which elapses before a yield-point elongation returns, the amount of that elongation and indeed the total amount and rate of strain-ageing, as measured by the other mechanical properties is very much dependent on the nature and degree of initial straining.

This paper is mainly concerned with the type of cold work produced by cold rolling and not that caused by straining in tension. For a given extension the ultimate strength is higher when that extension is performed by rolling than when it is performed by pulling. Although a given amount of ageing causes the tensile strength of the cold-rolled material to increase more, the amount of the returned yield elongation is much less. In other words cold rolling is much more effective than stretching in suppressing the yield elongation and the amount of the latter which returns on ageing is less.

Provided the amount of cold rolling is sufficient to eliminate the yield point then the greater its amount the less the rate of increase in yield stress on ageing, and hence the maximum increase is less, although, of course, the actual value is higher. On the other hand the effect on the ultimate strength and hardness is different and the greater the amount of cold rolling the faster is the rise in ultimate strength on ageing, and the greater the amount of maximum ageing. The actual value too approaches the figure of maximum ageing at an earlier stage in the process.

The effect of the degree of straining on the decrease in ductility is very similar to that on the ultimate strength and hardness. The decrease is more rapid and the total amount is more, the higher the amount of initial straining.

The effect on the yield-point elongation is more complicated. Small amounts of cold rolling of less than about 0.75 per cent extension do not remove the yield point elongation. The ageing of specimens, which have been cold rolled to a greater extent, causes a return of this yield-point elongation, but there is a delay in the return which increases slightly with the amount of initial cold work. The yield-point elongation of a 1 per cent skin-passed sheet begins to return after two days ageing at room temperature. The greater the amount of cold rolling the slower is the increase in this returned yield elongation with ageing and the less the final value. A word should be said about the change in the character of the returned yield-point elongation with increase in the degree of initial cold work. As the amount of elongation diminishes the shape of the curve changes, the upper yield point disappears and the curve tends to rise making the exact end of the elongation less definite.

Ageing does not continue indefinitely. After all the internal changes have been completed it ceases. This time is dependent on many factors : temperature of ageing, degree of straining, type of straining and steel composition. The top line in Table I is somewhere near complete ageing.

Practical Effects

Strain-ageing is not merely of academic interest. Its consequences can be very serious in the manufacture and use of tinplate and auto-body sheet and is a matter which has to be taken care of constantly.

All hot dipped tinplate is in the fully aged condition. The baseplate, in passing through the tinning machine will be at a temperature of about 330° C. and 240° C. respectively in the tin pot and grease pot for a total time of about 10 seconds and will subsequently stand in the pile at a temperature above room temperature. The total effect is that the plate suffers maximum ageing. In the hot-dip tinning machine the plate moves relatively slowly and the temperature-distance curve would show a fairly smooth rise to a maximum, a flat portion and then a slow fall.

The position in electrolytic tinning is somewhat different. The strip passes quickly through a series of units of varying temperature such that the temperature-distance curve varies in a serpentine manner. It is difficult to assess theoretically the total time-temperature ageing effect. Mechanical tests, however, show that ageing is not quite complete.

In tinplate practice tensile tests are rarely conducted as routine chiefly because of the time required for the test and the large area which has to be examined in the time available for an acceptance test. The tests normally employed are the Rockwell superficial hardness, the Erichsen Cupping Test and the Jenkins Bend.

The effect of ageing on the properties of temper-rolled T3, 0.0093 in. thick blackplate is shown by the difference in properties between blackplate and tinplate.

TABLE II

Mechanical properties before and after ageing: Tinplate.

	Rockwell 30T	Erichsen	J.B.
Blackplate	52	9.1	24/20
Electrolytic tinplate ..	55	8.5	24/19½
Difference	+3	−0.6	−½
Hot Dipped tinplate ..	56	8.3	24/19
Difference	+4	−0.8	−1

The increase in hardness and loss of ductility are, however, not in themselves a serious handicap in tinplate manufacture. In all tempers with the possible exception of Temper 1, deep drawing, the effect can be counterbalanced by slightly increasing the steel quality and the annealing cycle. Of course, in practice this is what is actually done. The main test point is at the temper mills after skin-passing and the acceptance standards are sufficient to allow for subsequent deterioration in mechanical properties caused by ageing. In the case of Temper 1, steel quality and processing conditions are usually near the limit of what is practical and if the customer desires to avoid this loss of ductility and is prepared to pay the extra cost, a so-called stabilized steel can be supplied. But usually this type of steel is specified when it is desired to avoid the surface blemishes that would be caused by stretcher strains.

In the case of the higher tempers, T4 to T6, provided the ductility is adequate, the increase of hardness due to ageing may be a positive advantage.

In the manufacture of tinplate, however, strain-ageing may also cause the return of fluting, a defect which is more troublesome than the slight loss of ductility and increase in hardness. The major portion of the tinplate manufactured is made into round cans of some sort and of these the area of tinplate required for the body is about twice that required for the ends, depending on the shape of the can. Thus about half of the make of a tinplate mill has to be made substantially non-fluting. This is brought about by giving the strip sufficient extension in temper rolling such that the ageing that occurs during tinning does not cause the fluting to return. The reason for this is that although the yield point comes back it is not of a very pronounced character and yield extension is small. It was discovered empirically during the early development of cold-reduced tinplate manufacture that if the temper mill rolls were given a shotblast finish, fluting could be removed by a much smaller amount of extension. Of course, the strip had to be given a bright pass afterwards to remove its rough surface. This effect is due to the fact that the surface of the strip is cold worked to much greater extent than the interior and acts as a shell which prevents the formation of flutes.

When the temper rolling is performed in a 2-stand 4-high tandem mill with shotblast work rolls in the first stand a total of about 2 per cent extension is required to ensure that fluting does not return after tinning.

In the case of auto-body sheet the difficulty due to the presence of a marked yield extension is usually stretcher strains. If the draw is sufficient these are subsequently drawn out as elongation proceeds, but obviously they are too unsightly to be tolerated on any exterior part of say a household appliance or a motor car in those portions of the part where the draw is insufficient to remove them. For this reason it is normal in press shops to roller level skin-passed sheets before pressing. In this operation the sheets are given a series of reverse flexings between two rows of staggered rolls. The yield point and yield extension are removed and consequently the danger of stretcher strains. The process however does not have any effect on the degree of ageing which has proceeded up to that time but tends to increase the rate of subsequent ageing. However, in addition to removing any yield elongation it also lowers the yield stress and thus makes pressing easier.

The loss of ductility which accompanies ageing is probably the most serious aspect of the effect of strain-ageing on skin-passed extra-deep-drawing sheet. The bulk of the product of a sheet mill is for extra-deep-drawing work and modern presswork is so exacting that there is not much margin of safety between the drawing properties of the sheets which make a satisfactory pressing and those which just fail. Hence any loss of ductility due to ageing can be significant.

The extent to which ageing affects the properties of extra-deep-drawing auto-body sheet is shown in Table III.

TABLE III

Mechanical properties before and after ageing: Sheet.

	A	B	C	D
Tensile strength tons/sq. in.	19.7	20.0	+0.35	+0.6
Yield stress	15.4	11.75	+3.0	+3.9
Total elongation on 8 in. per cent	35	35	−2½	−4
Rockwell "B" hardness	44.25	44.5	+3.5	+5.5
Yield elongation per cent	5–7	0	+2½	+4

Column A: the average mechanical properties of a typical extra-deep-drawing non-skin passed 20 gauge sheet.

Column B: the average mechanical properties which are obtained immediately after the sheet has been skin passed to the extent of 1.0 per cent extension.

Column C: the differences which are obtained after the sheet has aged for one month at room temperature.

Column D: the differences which are obtained after complete ageing.

In practice, of course, the material is pressed as soon after skin passing as possible. At best this must amount to a few weeks because of the time taken to complete processing, pack, deliver and line up in the press shop. The rate of strain-ageing varies of course with the time of the year but it also varies slightly from consignment to consignment in a manner which is not fully understood. Generally speaking if sheets are held more than six weeks and breakage arises the mills disclaim responsibility, provided the material was satisfactory on despatch.

Cause of Strain-Ageing

Many theories have been advanced to explain the phenomenon and it is not proposed to trace their history.

One of the most revealing pieces of work was that of Gensamer and Low[1]. Briefly they showed that by annealing low carbon rimming steel sheet in wet hydrogen, not only was the yield point removed in the as-annealed condition but the steel was completely non-ageing. This procedure removed all the carbon and nitrogen. These two elements were then individually re-introduced and the yield point and ageing characteristics returned. The general conclusion that ageing is caused by both carbon and nitrogen is beyond all possible doubt. Today nitrogen is regarded as the chief culprit.

Prior to the above work it had been found empirically that if rimming steel were treated with a slight excess of certain elements which were strong carbide and nitride formers, the steel was non-ageing. In the order of decreasing effectiveness, as measured by the percentage of the "free" element required, titanium[4], niobium[5] and vanadium[5] all act in this way. Of course, the amount of element which is required to be added depends on the amount of carbon and nitrogen present. Vanadium does not kill the steel or seriously interfere with the rimming action. Upwards of 1 per cent of vanadium is required, it is expensive and its use for producing a non-ageing steel has not been seriously taken up in practice.

A true non-ageing steel is rarely used in sheet and tinplate practice except occasionally in enamelling and then for a different reason. The so-called stabilized steels, however, are being increasingly used. These are steels killed with aluminium so as to leave an excess of say 0.04 per cent free aluminium in the steel[6]. They possess a marked yield extension after annealing, but after it is removed by skin passing its return by ageing is retarded. The Gensamer and Low index is frequently used for determining the strain-ageing characteristics of stabilized steel. In the case of extra-deep-drawing rimming steel this index is usually in the range 14 per cent to 22 per cent. In stabilized steel it is frequently zero and usually below 2 per cent. With indices in this region, stretcher straining is absent.

This behaviour of aluminium is probably explained by the fact that under steel making conditions it forms a stable nitride, but not a carbide. This would indicate that nitrogen plays a greater part in ageing than does carbon, a contention which is borne out by theoretical considerations.

The phenomenon of ageing has been a fruitful field for the elaboration of theoretical explanations. A few years ago what has become known as the dislocation theory was advanced by Cottrell and Bilby[3]. This explained many but not all of the known facts. More recently this theory has been extended by Jones and Owen-Barnett[7] and by Hundy[8], The latter admits that it embodies parts of an earlier theory by Edwards, Phillips and Liu[9]. It now explains most of the known facts.

The theory runs something as follows: Even cast metals and annealed metals contain imperfections in the lattice structure. One of these imperfections is the dislocation which was postulated on theoretical grounds before it was seen under the electron microscope. There are two manifestations of dislocations called edge and screw.

A photograph of several edge dislocations is shown in Fig. 6.

During cooling following annealing, the carbon and nitrogen atoms, which are in solid solution in the ferrite and are interstitial, migrate to the dislocations and anchor them. Thus the initial force necessary to cause slipping across a dislocation is higher than would otherwise be the case. Once the dislocation has been forced away from the accumulated atoms of carbon and nitrogen, the force required to move it is much less. This accounts for the higher and lower yield point and the yield elongation. During ageing, carbon and nitrogen atoms migrate to the new positions of the dislocations, locking them once more. This explains the return of the yield point but does not account for the increase in the yield and ultimate stress. The extension of the original theory by Hundy and others involves the question of the number of atoms that migrate to the dislocations and the increased number of dislocations caused by the cold work. Originally it was thought that these atoms only amounted to about one per atom plane, and that it

(*Continued in page* 601)

The Strain-Ageing of Mild-Steel Flat-Rolled Products

(*Continued from page 600*)

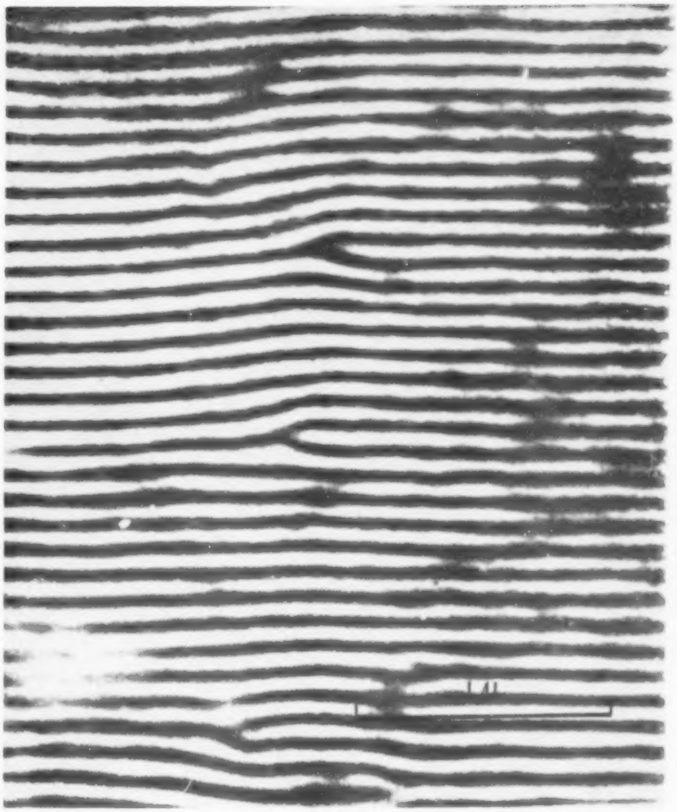


Fig. 6.—Edge dislocations in a gold-palladium film

was these atoms that migrated to the new position of the dislocations. Now it is thought that upwards of perhaps 50 are involved and that these are sufficient to form a sub-precipitate, *i.e.*, an actual precipitate, too small to be seen even under the electron microscope, but sufficient to cause a hardening effect. During cold work the number of dislocations increases enormously and the migration of atoms to these and the formation of sub-precipitates accounts for the observed increase in the ultimate stress. A theoretical calculation shows that the number of atoms available for locking the dislocations are not available in solid solution and it is postulated that the balance must come from resolution of some of the precipitates already formed in the body of the ferrite or at the grain boundaries.

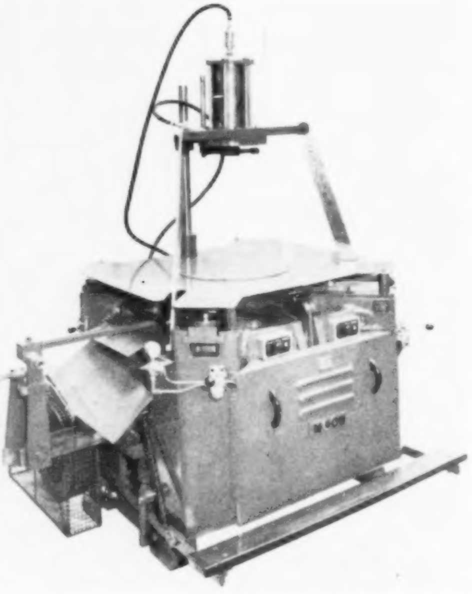
References

1. Low, J. R., and Gensamer, M., "Ageing and the Yield Point in Steel," (1943), *A.M.I.E. Tech. Pub.* No. 1644.
2. Hundy, B. B., "Accelerated Strain Ageing of Mild Steel," (1954), *J. Iron Steel Inst.*, **178** pp. 34-38.
3. Cottrell, A. H. and Bilby, B. A. (1949), *Proc. Phys. Soc.* **62** ser. A pp. 49-62.
4. Comstock, G. F., "The Strain Ageing of Killed Low-Carbon Steel, with Particular Reference to the Effect of Titanium," (1943), *Sheet Metal Ind.* **18** pp. 1527-34, 1723-30.
5. Edwards, C. A., Phillips, D. L. and Jones, H. N., "The Influence of some Special Elements upon the Strain-Ageing and Yield-Point Characteristics of Low-Carbon Steels," (1940) *J. Iron Steel Inst.* No. 11 pp. 199p-222p.
6. Hayes, A. and Griffis, R. O., "Non-Ageing Steels for Deep Drawing," (1934) *Metals and Alloys* **5** pp. 110-112.
7. Jones, B. and Owen-Barnett, R. A. (1954) *J. Iron Steel Inst.* **177** p. 209.
8. Hundy, B., B.B., "Strain-Age Hardening of Mild Steel." (1956) *Metallurgia* pp. 203-211.
9. Edwards, C. A., Phillips, D. L. and Liu, Y. H. *J. Iron Steel Inst.* (1943) **147** p. 145.

BARROW IRON WORKS SOLD

THE United Steel Companies Ltd. have purchased Barrow Steel Works, Limited, from the Iron and Steel Holding and Realisation Agency for the sum of £2,200,000. United Steel has managed this works since 1943 for a token remuneration, but as a conventional steel-producing unit, the works has not been economic throughout this period. Continuous casting was considered to be the most promising form of small-scale billet production, based on local scrap supplies, and a pilot continuous casting unit was installed in 1952. The process is now working successfully, and two full-scale twin-strand continuous casting machines together with a 20-ton electric arc furnace are being installed and are expected to come into production in the near future, and should provide billets at a cost which will enable the re-rolling mills to operate at a profit.

Trimming the Edges of Irregularly Shaped Drawn Sheet-Metal Stampings



(Courtesy of Moon Bros. Ltd.)

Fig. 1.—Machine for trimming the edges of stampings

TRIMMING of the edges of drawn or stamped sheet-metal components is an important and sometimes a surprisingly difficult operation. The range of different stampings of irregular shape is constantly increasing and so are the demands on the accuracy of square trimming of the edges because these must often be a fairly close-tolerance fit against other components of articles for which hand-finishing or selective fitting is out of the question.

This problem has been and is dealt with by a variety of methods, the best known of these being the conventional trimming press. However, this method is unsuitable for trimming the vast majority of such components for a number of reasons. For example, the trimming tools used on such presses are often very complicated and expensive as they must also incorporate means of converting the normally vertical stroke of the press into a horizontal trimming stroke. This often requires complex cam-operated mechanisms. Another equally serious disadvantage of this method is due to the fact that although relatively little power is required for the actual trimming operation, irrespective of the size of the component, a large component would obviously need a press with a press table of sufficient size to accommodate its trimming tool. The size of press therefore increases in approximately linear proportion with the size of the components and thus can become an uneconomic way of utilizing a large powerful and expensive press. Moreover, such a press adapted for trimming, cannot be expected to provide the kind of production rates commonly met in the manufacture of drawn components.

At the works of one of the leading metal stampers to the trade in the United Kingdom, a machine (Fig. 1) made by Moon Brothers Ltd. of Birkenhead, has been installed especially to perform trimming operations. The trimming tools, which are shaped to suit the component, are mounted on four reciprocating slides and run in strong guideways with adjustable gibs. The slides are arranged in two sets of opposite pairs, the blades of each set acting simultaneously and the two sets acting in sequence. The operating linkage of the slides is controlled by cams, and the actual cutting or trimming movement only takes a fraction of a second.

In operation, the component to be trimmed is placed over a tool block which is a close fit against the interior of the component and whose lower edge forms the counter blade. The component is firmly held in position by a pneumatically-operated chuck, acting above and controlled by two valves located at two adjacent corners of the machine. These valves have to be operated together, so that the hands of the operator are clear of the cutting zone at the appropriate time.

The trimming action is initiated by depressing a treadle. This engages the camshaft through a non-repeating rocker key clutch of the type normally used in power presses. As the camshaft is engaged, one pair of diametrically opposed cutter slides moves forward and shears the trimming edge against the cutting edge of the tool block. This action is extremely quick and occupies only part of the machine cycle, the remainder of the cycle consisting of the quick return of this pair of cutter slides, followed immediately by the identical forward and return movement of the other pair of slides. The cutting blades are arranged with sufficient overlap, and their method of operation

(*Continued in page* 603)

Trimming Stampings

(*Continued from page* 602)

positively prevents one pair of cutters from being started while the other pair is still in the shearing position. As already mentioned, the time required for the entire operating cycle is less than one second.

On completion of the shearing action, the pneumatic chuck is released and the trimmed component is raised off the tool block by spring-loaded ejector pads, to facilitate its removal.

In most cases, the trimmed scrap forms a band of metal, closed on itself. This scrap is split by an independently driven scrap cutter, and removed automatically by removal hooks, so that the operator needs only load the machine, actuate the controls and remove the finished part.

Careful attention has been paid to securing a high safety factor, and this was achieved by interlocking the clutch release with the pneumatic system, thus preventing the cutters from being engaged until both hands of the operator are on the pneumatic valves, outside the cutting zone.

The need for operator skill is confined to ensuring rapid loading and unloading of the machine, and outputs of the order of 45 to 50 parts per minute are by no means exceptional.

Basically, there are two versions of the machine: Models K.T. and J.T. The model K.T. can handle material with a thickness of up to 12 B.g. while the maximum thickness handled by the Model J.T. is 24 B.g. The maximum component diagnonal of the two models is 21½ and 17 inches, respectively. The design of the machine is also suitable for the subsequent addition of a transfer unit which would render the trimming operation fully automatic in cases where the cost of such accessory equipment can be justified by the length of production runs. The power requirements of the machines are quite modest, and amount to 5½ h.p. in the larger machine (including the separate scrap cutting and removal drive) and 4 h.p. in the smaller machine.

New Furnace Laboratory

(*Continued from page* 564)

Vickers projection microscope and a wide range of temperature measurement and control instruments are also available.

The department applies scientific principles to the investigation and development of all types of equipment manufactured by the company. Work includes examination of basic design principles, the testing of specific components, the performance evaluation of prototype plant and the testing and final adjustment of specialized production equipment to provide data for future design and for the instruction of field engineers.

Many investigations are currently in progress, one of which is of special interest to the sheet-metal industry, *viz.* the bright annealing of stainless-steel strip.

The bright-annealing process is carried out in an atmosphere of cracked ammonia and conventional annealing equipment incorporates a heat-resisting nickel-chrome-alloy muffle to exclude contamination of the gas. This latter is expensive and for many applications will need to be replaced from time to time. In addition, the heating elements are necessarily fitted outside the muffle and their duty is thus made arduous.

In the experimental furnace, the metal muffle has been eliminated by lining the furnace chamber with refractory specially selected for its ability to remain in equilibrium with reducing atmospheres of low dewpoint at high temperatures. By this means, the disadvantages characteristic of the conventional equipment are overcome.

The furnace in the laboratory incorporates strip handling gear and experiments can be undertaken with strip up to 6 in. in width. Work has been carried out with austenitic, ferritic and martensitic stainless steels with completely satisfactory results in all cases.

Extension of the new principle to other bright-annealing applications is receiving consideration.

"The Design and Use of Modern Slide Rules"

WE regret that an error occurred in the article under the above title in the June issue of SHEET METAL INDUSTRIES. In the second column of page 434 ". . . displacement of 10 suggests itself . . ." should read "displacement of $\sqrt{10}$ . . ."

FIFTH PRODUCTION EXHIBITION

THE fifth Production Exhibition is to be held in the National Hall at Olympia, London from April 30 to May 5, inclusive, 1962. This exhibition provides a biennial survey of current developments in the techniques of production, of great interest to management and all those engaged in planning efficient industrial production. Working exhibits of machinery, ancillary aids and services are also featured.

Large firms can demonstrate how the application of principles of good management and productivity result in better and cheaper products and can indicate the wide range of production covered by roups, gand the smallest firms can exhibit services and products with industrial applications of value to industry.

Further details can be obtained from The Production Exhibition, 11 Manchester Square, London, W.1. Tel.: HUNter 1951.

INSTITUTE OF SHEET METAL ENGINEERING • *Recent and Forthcoming Events*

1961 ANNUAL CONFERENCE

Outline Programme

THE 1961 Autumn Conference of the Institute, together with the 12th Exhibition of Sheet Metal Working Equipment and Techniques will be held at the Imperial Hotel, Birmingham on November 7-9, returning to the Midlands for the first time since 1952.

The papers to be presented at the four technical sessions all relate to subjects of very great topical interest and in line with current production trends.

The outline programme is as follows:

Tuesday, November 7.

11.30 a.m.	Official opening of 12th Annual Exhibition of Sheet Metal Working Equipment and Techniques.
2.30 p.m.	1st Technical Session—GENERAL SUBJECTS.

Wednesday, November 8.

9.30 a.m.	2nd Technical Session—PROBLEMS INHERENT IN FEEDING IN MODERN HIGH-SPEED PRESSWORK PRODUCTION.
1.00 p.m.	Buffet Luncheon.
2.30 p.m.	2nd Technical Session (*continued*).

Thursday, November 9.

9.30 a.m.	3rd Technical Session—FEEDING, SLITTING AND PROCESSING OF HEAVY COILS IN ROLLING MILLS, PRESS SHOPS AND WAREHOUSES.
1.00 p.m.	Buffet Luncheon.
2.00 p.m.	4th Technical Session—EFFECTS OF DEFORMATION AT VERY HIGH RATES OF STRAIN.

12th EXHIBITION OF SHEET METAL WORKING EQUIPMENT and TECHNIQUES

In association with the annual conference will be staged the 12th Exhibition of Sheet Metal Working Equipment and Techniques which has in past years attracted an informed and interested attendance in ever increasing numbers. As a specialist exhibition designed for study and discussion by a specialist public this exhibition performs a unique and particularly valuable function. As usual, the number of exhibitors will be strictly limited and forms of application for space will be available in the near future.

The detailed programme of this Conference will be issued at a later date but in view of the shortage of hotel accommodation in Birmingham, members and others intending to attend the Conference are advised to reserve their requirements well in advance.

MIDLAND BRANCH WORKS VISIT

The venue for the summer works visit of the Midland Branch, which is a particularly popular feature of the Branch programme, was this year the works of Samuel Fox and Co. Ltd. at Templeborough near Sheffield. The company, which is one of the branches of the United Steel Companies Ltd., concerns itself largely with special steels, chiefly stainless and alloy steels, and about half of its total production is ultimately used in motor-vehicle construction. Other products are laminated and coil springs, watch springs and umbrella frames, while by far the greatest proportion of razor blades manufactured in Great Britain are made of Fox steel.

After a pleasant ride through some beautiful Derbyshire countryside, the visiting party arrived at the works in time to look round one of the melting shops before being most hospitably entertained to luncheon by the directors of the company.

The tour continued in the afternoon in the rod bar mill, which is one of the most modern installations of its kind in the country and the visitors were much impressed by the high degree of mechanization which has been achieved. The strip mills provided the party with an unusual opportunity to compare old (soon to be obsolete and replaced) methods with modern highly mechanized ones making use of such advanced techniques as closed circuit television.

Throughout the visit the party was impressed by the high standard of good housekeeping which was everywhere apparent and the considerable emphasis which had been placed on maintaining safe working conditions. At the close of the meeting thanks were expressed to the directors and staff of the company for what had been a most interesting and worthwhile visit. On the return journey to Birmingham, dinner at Uttoxeter provided a pleasant conclusion to an enjoyable day.

FOR OUR OVERSEAS READERS

(Continued from page 555)

Résumés des Principaux Articles

L'emploi des Glycols en tant que dissolvants dans les décapants de soudage au chlorure de zinc .. page 583

Par C. J. Thwaites, M.Sc., A.R.S.M., A.I.M.

Cet article indique que le glycol polyéthylène d'un poids moléculaire de 200 est un dissolvant convenable pour le chlorure de zinc en présence d'une trace d'acide chlorhydrique, ou d'autres chlorures. Alors que le prix de revient s'en trouve augmenté, l'avantage principal d'une absence de crachements au cours du soudage peut justifier, en certains cas, un essai en usine, pour lequel une composition convenable est présentée.

Alimentation des presses automatiques en bandes et en rubans .. .. page 588

Par A. P. J. Soepnel.

Il est fait la description d'un appareil d'alimentation des presses à manivelle et à excentrique qui, tout en conservant un haut degré de précision pratique, permet une production horaire de 2 à 4 fois superieure à celle des appareils habituels — à condition, toutefois, que la presse employée soit capable de travailler au régime supérieur exigé, sans subir d'effets nuisibles. Le travail peut se faire en utilisant des matrices progressives complexes ou des outils-multiples.

Le Vieillissement sous l'effort des Produits d'acier Doux, Lamines à Plat .. page 595

Par W. J. S. Roberts, B.Sc., F.I.M.

Aucune tentative n'est faite dans ce mémoire d'examiner l'ensemble de la question du vieillissement. Par exemple, la trempe par vieillissement en est exclue et il n'y est fait aucune tentative de traiter du sujet du point de vue historique. La considération principale est la description, en termes simples, de la nature du vieillissement sous l'effort et de son effet sur les opérations quotidiennes dans la fabrication du fer blanc et des tôles par le laminage à froid. Les principes du vieillissement s'appliquent exactement de la même façon aux tôles normalisées et au fer blanc laminé entassé, mais pour ce dernier, les difficultés relatives à la limite d'allongement marquée sont absentes du fait de l'importance de la granulation.

Zusammenfassungen der Hauptartikel

Die Verwendung von Glykolen als Lösemittel für Zinkchlorid Lötflussmittel .. Seite 583

Von C. J. Thwaites, M.Sc., A.R.S.M., A.I.M.

Dieser Aufsatz zeigt, dass Polyethylenglykol mit einem Molekulargewicht von 200 ein zufriedenstellendes Lösemittel für Zinkchloride ist, wenn Spuren von Salzsäure, oder anderen Chloriden, vorhanden sind. Obwohl damit Mehrkosten verbunden sind, liegt der Hauptvorteil darin, dass kein Spritzen vorkommt, wenn gelötet wird und dies rechtfertigt Werkstättenversuche für gewisse Fälle, wofür eine geeignete Zusammensetzung zwecks Versuchen, vorgeschlagen wird.

Der Vorschub von Bändern und Streifenmaterial in automatischen Pressen Seite 588

Von A. P. J. Soepnel.

Es wird ein Material —Vorschubapparat für Kurbelwellen— und Exzenterpressen beschrieben, mit welchem eine sehr tunliche Genauigkeit aufrechterhalten werden kann, wobei Stundenleistungen erreicht werden können, die 2 bis 4 —mal grösser sind als es unter Verwendung üblicher Vorrichtungsarten möglich war. Es wird jedoch die Bedingung gestellt, dass die dabei verwendete Presse auch die notwendige höhere minutliche Hubzahl gestattet, ohne Schade zu erleiden.

Reckalterung Flachgewalzter Erzeugnisse aus Flußeisen Seite 595

Von W. J. S. Roberts. B.Sc., F.I.M.

Die Abhandlung versucht nicht, eine umfassende Übersicht über das Thema der Alterung zu geben. Zum Beispiel schließt sie die Abschreckalterung aus, und es wurde nicht versucht, die Angelegenheit von der geschichtlichen Seite zu behandeln. Der Hauptzweck ist, in einfacher Weise zu beschreiben, was Reckalterung bedeutet und in welcher Weise die Behandlung von Weißblech und verzinnten Stahlplatten während der täglichen Erzeugung durch die Kaltwalzmethode beeinflußt wird. Die Prinzipien der Reckalterung werden in genau der gleichen Weise angewendet wie im Fall geglühter Platten und paket-gewalzter Weißbleche, aber bei den letztgenannten waren wegen der größeren Körnung Schwierigkeiten im Zusammenhang mit einer ausgesprochenen Fließdehnung nicht vorhanden.

Résumenes de los Artículos Principales

El empleo de glicoles como solventes en fundentes para soldar a base de cloruro de cinc .. .. página 583

Por C. J. Thwaites, M.Sc., A.R.S.M., A.I.M.

Este artículo indica que el glicol de polietileno de un peso molecular de 200 resulta un solvente satisfactorio para el cloruro de cinc hallándose presente una traza de ácido clorhídrico u otro cloruro. Aun cuando esto supone un coste mayor, la principal ventaja que es la falta de salpicadura durante la soldadura, bien puede justificar, en ciertos casos, un ensayo de taller y se da un composición adecuada para semejante ensayo.

Alimentación de materiales en forma de cinta y fleje a las prensas automáticas página 588

Por A. P. J. Soepnel.

Se describe un aparato alimentador de materias primas para prensas de cigüeña y excéntricas en las cuales, aun manteniendo una precisión muy prática, puede alcanzarse una producción de 2 a 4 veces mayor de la que resulta posible con el dispositivo de tipo corriente, siempre y cuando la prensa empleada sea capaz de trabajar a un número mayor de golpes por minuto sin efectos dañosos.

El envejecimiento por deformación de productos de acero dulce laminados en plano .. .. página 595

Por W. J. S. Roberts, B.Sc., F.I.M.

En este documento no se intenta hacer un estudio general del tema del envejecimiento. Por ejemplo, excluye el endurecimiento por envejecimiento por sumersión y para nada trata del asunto desde el punto de vista histórico. El onjeto principal es describir, en tèrminos sencillos, lo que es el envejecimiento por deformación y como influye sobre las operaciones cotidianas en la fabricación de hojalata y chapa por el procedimiento de reducción en frio. Los principios del envejecimiento por deformación son igualmente aplicables de la misma manera precisamente en el caso de chapas normalizadas y hojalata laminada, pero en el último caso las dificultades resultantes de un estiramiento pronunciado de cesión se hallaban ausentes debido al grano de gran tamaño.

SHEET METAL NEWS

FEATURING EVENTS AND PERSONALITIES IN THE INDUSTRY

MIDLANDS ROLLING MILL HOLDS OPEN DAY

Stourbridge Rolling Mills Ltd. Show Latest Addition to Range of Products

ON July 11 last, Stourbridge Rolling Mills Ltd. entertained at their works representatives of some 150 light engineering companies, the main purpose of the occasion being to give steel users the opportunity of seeing the latest addition to the company's products, *viz:* sheared cold-reduced strip being produced and handled.

The company was incorporated in 1906 and employs about 230 people, output of the works being about 20,000 tons of steel strip, heavy rolled flats and flattened wire per annum. The new product is especially useful for those users who wish to take advantage of continuously feeding pressworking and stamping machinery with coil. The finished material is continuously sheared to any required width in a 36-in. wide slitting line from a parent coil which may weigh up to 9 tons. The slitting line, shown below, consists of an uncoiler, entry roller leveller and gang slitter built by Fred Cam Engineers Ltd. and a Pratt Bros. guillotine.

The wire flattening department, which handles wire up to 0.540 in. dia. incorporates 2-high mills of various sizes including a 2-stand 2-high tandem mill of W. H. A. Robertson manufacture. This department also includes roller flattening and automatic cut-to-length equipment.

Bright-annealing equipment in the works consists of nine G.E.C. 110-kW. pit-type furnaces using burnt town's gas atmosphere. Pickling equipment includes a Rüthner drum-type plant, pickling being effected in 15 per cent H_2SO_4 followed by water washing and dipping in soluble oil.

Cold-rolling mills vary in size and are mostly 2-high. A recent installation is a Robertson 4-high mill for rolling thinner gauges up to 9 in. wide. This mill is fitted with T.T.H.-Rank full A.G.C. A typical rolling schedule, starting with strip 0.030 in. thick involves rolling to 0.029 in. in two passes, followed by an anneal and rolling to finish gauge of 0.018 in.

The hot-rolled starting coil used by the company is supplied by John Summers and Sons Ltd. in EN2A and 2B qualities. The company point out that the new product is not competitive with the company's conventional range of cold-rolled steel strip, which is finished with a closer surface and to tighter dimensional tolerances.

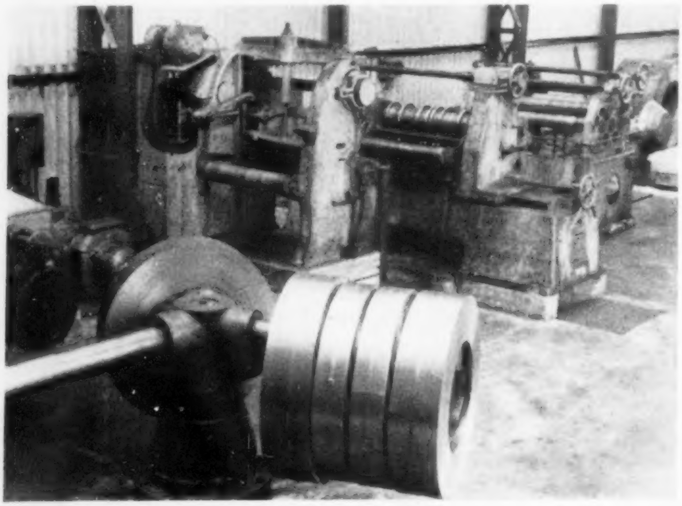
A unique feature of the occasion was the display of material handling appliances for heavy coils arranged in co-operation with several manufacturers, *viz:* Humphris and Sons Ltd., Poole, Press Equipment Ltd., Birmingham, Rockwell Machine Tool Co. Ltd., London, and The Yale and Towne Manufacturing Co. Ltd., Wednesfield.

Humphris and Sons Ltd. manufacture a wide range of coil strip handling machines including coil reels of various types, coil cradles, combination decoilers which incorporate straightening rolls, coil stands, recoilers, power-press feed attachments, cut-to-length press feed lines, etc. and the well-known range of "Pressmaster" presses. A typical coil-feed line was on show.

Press Equipment Ltd., manufacture the bow-feed equipment for standard presses (shown and described in the series on John Thompson Motor Pressings), combined coil cradle and straightening machines, coil cradles, pedestal-type coil holders, transfer-feed devices, panel unloaders, "mechanical hands", etc.

The Rockwell Machine Tool Co. Ltd. featured the British-made range of press-shop equipment designed by the U.S. Tool Co. Inc., U.S.A. This range includes precision slide feeds operated by the press crankshaft, slide feeds for long pitches independently motor driven, plain and automatic coil stock reels

(*Continued in page* 607)



General view of wide slitting line at Stourbridge Rolling Mills

INTERNATIONAL RESEARCH CORPORATION STARTS OPERATIONS IN U.K.

A NEW corporation to provide research, technical information, investment advisory, and management services in the United States and Europe has been organized by Dr. Clyde Williams, Columbus, Ohio, and his American and European business associates.

Dr. Williams has been a frequent visitor to London between 1951 and 1956 when, as president of Battelle Memorial Institute, he established Battelle's European Operations which consisted of research institutes in Frankfurt and Geneva, and technical offices in London, (at John Adam House, John Adam St., London, W.C.2), Paris, Milan and Madrid.

In 1956, Dr. Williams discussed plans for building a laboratory in Britain with Mr. Harold MacMillan (then Chancellor of the Exchequer), Mr. Peter Thorneycroft (President of the Board of Trade), and Sir David Eccles (Minister of Education). Incorporated in Ohio, the Clyde Williams Corporation has its main offices at 50, West Gay Street, Columbus; branch offices will be maintained in London and Paris. Dr. Clyde Williams, Dr. F. R. Hensel, Dr. L. Kermit Herndon, and Mr. H. H. Jackson, have been appointed to the board of directors. Officers of the Corporation will be: Dr. Williams, president and chairman; Mr. Jackson, executive vice-president; Dr. H. E. Zentler Gordon, vice-president; Mr. Clyde Williams Jnr., secretary and treasurer, and others to be named.

"A major purpose of the company is to provide liaison between European and American technology," Dr. Williams stated in announcing the launching of the new enterprise. "Tremendous progress is being made in research and technology on each side of the Atlantic, yet—at the businessman's level—there are inadequate mechanisms for communications and integration of technological developments. As a result, benefits that could accrue to companies both in the United States and Europe are delayed in coming. What we are doing is to hasten the process of across-the-Atlantic information dissemination as it relates to technology to markets for products, and to finance and investments".

Dr. Williams, who introduced the concept of contract research in Europe with his establishment of the laboratories of Battelle Institute in Frankfurt, Germany and Geneva, Switzerland, approximately ten years ago, said that among other things the new firm is advising American companies where to place research projects. For this purpose, European nationals highly trained in research management will be attached to the London and Paris Offices.

INTERNATIONAL COPPER DEVELOPMENT

MEMBERS of the Copper Development Directors Committee recently assembled at Folkestone for their 11th meeting. Representatives from Belgium, Canada, Denmark, France, Germany, Italy and Switzerland attended. The agenda of each day's conference included a variety of technical and administrative matters of mutual concern to each of the centres.

A tour of places of local interest was included during the week's arrangements, which were organized by the Copper Development Association of Great Britain.

During the course of the meeting, the formation of a Copper Development Centre in Australia was announced.

Stourbridge Rolling Mills Ltd.

(*Continued from page* 606)

and straighteners, combination automatic cradle and stock straighteners, scrap cutters, etc. Also featured was the U.S. Tool Company British-built Multi-slide press.

Yale and Towne demonstrated one of their 51 series electric fork-lift trucks, specially adapted for coil handling. The 51 series is available in capacities from 5,000 to 7,000 lb. and has hydraulically operated lift and tilt.

ALCAN LUTON OFFICE ASSUMES AREA STATUS

ALCAN INDUSTRIES LTD. (formerly Northern Aluminium Co. Ltd.), announce that their Luton sales office territory will now take in Oxfordshire and the southern portions of Buckinghamshire, and Essex hitherto covered by their London sales office.

The Luton office, which opened at 57, Bute Street, Luton in 1956 as a regional office under the London sales office, now assumes Area status. Mr. J. B. Rayner, who has been manager of the office since its opening, continues in that appointment.

The area for which the Luton office will be responsible covers Bedfordshire, Buckinghamshire, Cambridgeshire, Essex, Hertfordshire, Huntingdonshire, Norfolk, Northamptonshire, Oxfordshire, Soke of Peterborough, and Suffolk.

OBITUARY

Sandland: It is with deep regret that we announce the death of Mr. George Sandland of The International Nickel Company (Mond) Ltd. who, at the height of his career, died suddenly when returning from a company sports outing at Birmingham. Mr. Sandland, who will be remembered by many for his vigorous activities on his plating campaign, had been with the company for 35 years.

Trained as an engineer-designer with Vickers-Armstrong, he joined the late Sir William Griffiths and Miss E. W. Parker to form the triumvirate who transformed the Development and Research Department into a highly valued asset. He saw the very first issue—and many subsequent issues—of the Nickel Bulletin through the press to a point where it was considered a major contribution to metallurgical literature.

During the war he worked in the Development and Research Department in the London office. After the war he joined the Publicity Department, where he once again distinguished himself by his inventive mind and characteristic zeal. Latterly he has been prominent in the Nickel Plating Labelling Scheme, which is now reaching a state of maturity.

Robinson: Mr. Noah Robinson, joint managing director of Willenhall Motor Radiator Co. Ltd., Neachells Lane, Willenhall, for the past three years, has died at the age of 53. He had been ill for about six months.

Later this year Mr. Robinson would have been with Willenhall Motor Radiator Co. for 40 years. He joined the firm direct from school and became its joint managing director in August, 1958.

Mr. Robinson was also a director of Line Transport Ltd., Bilston and of D.K.R. Scooters Ltd., Pendeford, Wolverhampton. He was the "R" name of the scooter company.

EXPANSION OF CHARLES CHURCHILL GROUP

THE Charles Churchill Group of Companies announce a further step in their expansion plans with the purchase of Henry Milnes Ltd. of Bradford, manufacturers of boring machines, lathes and other machine tools.

In the past year the Group has been expanded by the acquisition of a number of manufacturing units putting into effect one of the major recommendations of the Mitchell Report.

This acquisition has followed the Group's practice of ensuring the continuance in office of the existing management.

Henry Milnes Ltd. have developed a range of machine tools incorporating unique features, in particular their fine boring machines. It can be confidently expected that there will be a ready demand for these and their other machines both at home and overseas.

AEI CRT SERVICE FACILITIES

ASSOCIATED ELECTRICAL INDUSTRIES have closed their service depot for Ediswan Mazda cathode ray tubes at 92 Oxford Road, All Saints, Manchester 13. Service to dealers in the North-West area will now be maintained from the AEI CRT service depot at 53, Trafalgar Street, Sheffield 1, under the supervision of Mr. D. A. Ward. Telephone number: Sheffield 27004.

SCHLOEMANN TO BUILD BILLET MILL FOR A FRENCH STEELWORKS

THE Société Métallurgique de Knutange S.A. has placed a contract with Schloemann Aktiengesellschaft, Düsseldorf, for the manufacture of a 32-in. two-high reversing billet mill. In addition to the roll stand unit, Schloemann are supplying the roller tables, a grip-type tilter, a hot saw, two hot shears and the hot banks. The new mill is due to go into production in mid-1962.

NEW HEAD SALES OFFICE AND SHOWROOM FOR G. A. HARVEY

HARVEYS' new head sales office and showroom in Villiers House, Strand, W.C.2, was officially opened on June 26 by Paul Reilly, Esq., director of the Council of Industrial Design.

The new office and showroom are on the first floor of a modern building and have an area of 6,500 sq. ft. In the showroom are exhibited many items from the Harvey and Harvey-Milner ranges of steel office furniture and partitioning, while in the reception area are coloured transparencies showing examples of production from Harveys' other departments which include heavy fabrication, light fabrication, sheet metalwork, metal perforation, wirework and weaving and galvanizing.

The offices provide accommodation for senior personnel of the sales department and also for the manager, sales representatives and staff of the London Branch office. The opening of the new head sales office and showroom in Villiers House, coupled with the chain of six new provincial offices, provides a notable milestone in the history of the company.

New Post-graduate Courses

TWO post-graduate courses are being arranged for the Autumn Term, 1961, by the College of Advanced Technology, Birmingham, as follows: (1) *Practical Implications of Metal Physics*: a course of ten lectures by leading authorities, on Tuesday evenings, commencing October 10, 1961. Tutor: Dr. T. Ll. Richards. (2) *Technology of Non-Ferrous Secondary Metals:* a course of ten lectures on Wednesday evenings, commencing October 11, 1961. Topics covered will include surveys of non-ferrous metals and alloys, sampling and sorting, melting and refining techniques and commercial practice.

Further particulars and application forms may be obtained from the Bursar, College of Advanced Technology, Gosta Green, Birmingham, 4.

WELDING EQUIPMENT DIVISION FORMED BY ENGLISH ELECTRIC

THE welding business of English Electric has been co-ordinated in a newly-formed Welding Equipment Division which is being set up at the company's Accrington Works (Telephone: Accrington 33241).

The manager of the Division will be Mr. R. H. Boughton; the chief engineer Mr. F. Mullery; and the sales manager Mr. E. H. Ayres.

NICKEL PRICE

TO assist in offsetting higher and mounting costs since the Company's last price rise four-and-a-half years ago, The International Nickel Company of Canada Ltd. have announced new and increased prices for its refined nickel. The new base price for refined nickel in Europe is £660 per long ton in the U.K., representing an increase of £60 per ton. Appropriate increases are being introduced for other countries. New prices are being announced for other forms of primary nickel.

In announcing the present price changes, The International Nickel Company of Canada Ltd., point out that since the last rise in the nickel price in Decembe: 1956, the company has absorbed mounting costs of all kinds. As a part of the company's policy of stimulating the expansion of uses for its nickel in preference to other materials through providing steady prices for its customers over the longest possible periods, it has deferred any change in its prices until this time.

MAKE IT YOURSELF

Boulton Paul Aircraft Co.'s New Rubber Press Technique

BOULTON PAUL AIRCRAFT LTD., of Wolverhampton, are operating their own Suproform hydraulic rubber press for the production of a wide range of metal pressings ranging from tableware to motor-car components.

An early result of this development by this old-established aircraft firm was seen at the Leipzig Spring Trade Fair in the form of a prototype ornamental metal panel in "Stelvetite" for the exterior decoration of buildings.

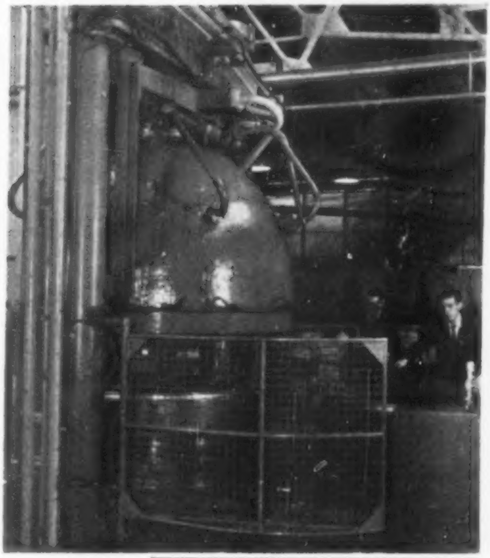
The new Boulton Paul press employs a shaping die in the customary manner, but the pressure applied to an elastic diaphragm within a large domed chamber comes from hydraulic fluid.

It is claimed by the makers that this new rubber press technique provides a saving of up to 90 per cent as compared with mechanical press tool costs. Owing to the cheapness of production, decorative metal panels with a high degree of definition for individual buildings now become an economical proposition. This applies even to a small single panel carrying an ornamental motif or insignia.

In providing various equipment, such as tableware for hospitals and the home, press sheet metal work for the aircraft and motor industry, and ornamental panels for the building trade, the Suproform press also offers other considerable advantages over the orthodox rubber bolster press, one of which is that the surface of the material produced is free of any blemish.

A second consideration is that the reaction to the variable pressing load, ranging up to 5,000 lb. per sq. in. is transmitted entirely through the locking means holding the fluid pressure chamber and the rigid closure or platen together, so that the heavy hydraulic rams and supporting pillars and frames used in conventional presses are unnecessary, in spite of the fact that the Boulton Paul device weighs approx. 100 tons.

(Right).—Hydraulic rubber press



CHANGE OF NAME

ESTABLISHED in 1915 at Irvine, Ayrshire, the Ayrshire Dockyard Co. Ltd., announces that it has now changed its name to Ayrshire Metal Products Ltd.

The change has been made because since 1938 ship repairing work has given way to light engineering and today the company is one of Britain's leading producers of cold formed sections, metal partitions, and other metal products. Announcing the change, the company said: "It was felt that the time had come to change the company's name to one more appropriate to its products, and this has now been done. There is no change in the company's ownership or directorate."

The name was the last link with what was once one of Ayrshire's main industries. Ship-repairing started in Irvine on the site now occupied by the company, 140 years ago.

SIR WALTER PUCKEY PRIZE

THE first award of the Sir Walter Puckey Prize was made to Mr. L. C. Lambert, Dip.Tech. (Eng.), at a meeting of the Wales Region of The Institution of Production Engineers recently. The presentation was made by Sir Walter Puckey, Past President of the Institution.

The Prize is an annual award of fifty pounds, open to first-year students taking Diploma in Technology courses in any branch of engineering in any College in England and Wales. It is made for an outstanding project in a production engineering subject.

Mr. Lambert was a Final Year student at the Welsh College of Advanced Technology during the session 1959/1960. He obtained the Diploma in Technology (Eng.) in September, 1960, with Second Class Honours, and his project was on "Friction Welding".

AGENCIES

PEARSON PANKE LTD. announce that they have been appointed Agents for the U.K. for the Maypres range of cold-forging presses and for Georg Achtermann who build a comprehensive range of dieing presses of advanced design, in addition to smaller C-frame presses, under the name of ACOMA.

WITH the exception of Cincinnati press brakes and shears, all machine tools previously sold by E. H. Jones (Machine Tools) Ltd., Hove, are now handled directly by the sales department of the parent company, Kearney and Trecker-C.V.A. Ltd., Garantools House, Portland Road, Hove.

It is emphasized that there is no change in the parent company's manufacturing programme.

CHANGES OF ADDRESS

THE London sales offices of the Evode Group of Companies have moved to bigger premises at 450/452, Edgware Road, W.2. Telephone: AMBassador 2425.

The storage facilities at Greenford have been enlarged to cater for the continued demand for the Group's products.

DAVIS SHEET METAL ENGINEERING CO. LTD. have moved to 27/37, Garman Road, Tottenham, London, N.17. Telephone: TOTtenham 3262/3/4.

APPOINTMENTS and STAFF CHANGES

Mr. R. F. G. Lea, deputy chairman and joint managing director of CIBA (A.R.L.) Ltd., Duxford, Cambridge, has been appointed a director of **CIBA Clayton Ltd.,** Manchester.

* * *

The Gisholt Machine Co. (Great Britain) Ltd. announce the appointment of Mr. S. W. Perkins to the board of directors. Mr. Perkins is a director of Wickman Ltd., sole agents in the United Kingdom for Gisholt machines.

* * *

The Wellman Smith Owen Engineering Corporation Ltd. announce the following executive appointments:

Mr. W. H. Day as commercial director, and has relinquished his position as secretary; Mr. C. D. Wattleworth, assistant managing director (technical), and Mr. D. A. Hume, assistant managing director (commercial); Mr. D. G. Felton succeeds Mr. Day as secretary of the Corporation; Mr. A. T. Easterbrook has been appointed general manager of the Furnace Building and Contracting Department in succession to Mr. G. Talbot, who has resigned from the company's service.

* * *

Mr. Norman Readman, managing director of the Consolidated Pneumatic Tool Co. Ltd., of 232, Dawes Road, London, S.W.6, has been elected president of the **Chicago Pneumatic Tool Co.,** New York, to succeed Mr. Guy J. Coffey.

Mr. Coffey becomes chairman of the board in succession to Mr. H. Arnold Jackson who has retired, although remaining a director and chairman of the Executive Committee.

* * *

Mr. J. S. A. Bunting, formerly joint divisional general manager, has been elected to the board of **Associated Electrical Industries (Woolwich) Ltd.**

The following appointments have also been made in Cable Division:

Divisional general manager and director of A.E.I. Divisional Management Company: Mr. E. J. Vidler; Divisional commercial manager: Mr. F. V. Vaissiere; Divisional manufacturing manager: Mr. V. L. J. Plascott; Divisional chief engineer: Mr. W. G. Hawley.

The operation of A.E.I. Cable Division is now organized into four product groups: Power Cable (sales manager: Mr. K. S. Estlin); Super tension cable (sales manager: Mr. R. G. Holland); Rubber and Plastic Cables and Wires (sales manager: Mr. D. Beavan); Distribution Equipment and Accessories (sales manager: Mr. H. Hubbard).

* * *

The **Minister of Power** has re-appointed the following members of the Iron and Steel Board:

Sir Cyril Musgrave, K.C.B., chairman; Sir Lincoln Evans, C.B.E., deputy chairman; Mr. A. G. Stewart, part-time member.

The Minister has also appointed Mr. N. C. Macdiarmid as a part-time member in place of Mr. Arnold E. Pearce, whose appointment has expired.

* * *

Mr. Archie Pressley, manager of the machine tool section of the Machinery Department of **Thos. W. Ward Ltd.** has retired after over 51 years' service with the company. At a special lunch to mark his retirement Mr. Harold Vernon, M.I.P.E., a director of the company presented an inscribed silver salver to Mr. Pressley on behalf of his senior staff colleagues.

* * *

Tarmac Ltd. announce the following appointments to subsidiary boards: Mr. R. H. Morray-Jones, director of Tarmac Roadstone Ltd.; Mr. N. V. Main, director of Tarmac Vinculum Ltd.

* * *

Mr. R. G. Huxtable, M.B.E., is now secretary of **The Gas Council,** in succession to Mr. Wilfrid Bailey, who is now deputy chairman of the Southern Gas Board.

Mr. Huxtable has been secretary of the South Eastern Gas Board since 1956, and was previously the Board's solicitor.

* * *

The Heavy Plant Division of **Associated Electrical Industries Ltd.** has established a Service Department, with headquarters in Rugby, to co-ordinate after-sales service for all its products. The manager of this department is Mr. B. M. Swift, M.U.E.E.

The following appointments are also announced by A.E.I.:

Mr. D. Major, B.A., B.Sc., as assistant chief engineer of the X-ray department of Instrumentation Division; Mr. J. H. Elvin as assistant superintendent, Traction Manufacturing Department.

* * *

The appointment has been announced of Mr. R. P. Mackay to be superintendent, Steel Plants, of the Steel Division of **The Steel Company of Wales Ltd.**

With the advent of new processes of steelmaking and new strip mills, the markets available to the company are constantly changing. The higher management of the company, appreciating this, considers that it is now appropriate to unify and strengthen its research activities which have previously been organized on a Divisional basis.

Dr. C. S. Ball, B.Met., Ph.D., F.I.M., at present superintendent of research, Steel Division, has been appointed research controller, responsible to the managing director, with the duty of developing and increasing the scope of the company's research facilities. This will include the co-ordination and, where appropriate, unification of the present organizations.

It is intended that a start will be made immediately on construction of the research laboratories at Port Talbot.

* * *

The Council of the **Institution of Production Engineers** announces that Mr. Harold Burke, M.I.Mech.E., M.I.Prod.E., has been elected to the Presidency for 1961/62.

The vice-president for 1961/62 is Mr. R. Ratcliffe, C.B., M.B.E., M.I.Mech.E., M.I.Prod.E., Controller of the Royal Ordnance Factories.

Mr. R. H. S. Turner, M.A. (Cantab.), M.I.Prod.E., director and works manager of Associated Electrical Industries (Manchester) Ltd., has been re-elected to a second term as chairman of council.

Mr. A. L. Stuchbery, M.I.-Mech.E., M.I.Prod.E., chief technical engineer of The Metal Box Co. Ltd., has been re-elected vice-chairman of council.

Mr. W. S. Horwood has been appointed assistant education and technical officer to the Institution.

* * *

Mr. Ernest Butten, chairman of Personnel Administration Ltd., has been elected chairman of the **Management Consultants Association,** in succession to Mr. W. Coutts Donald whose term of office has now come to an end.

NEW OFFICES FOR G.K.N. GROUP

GKN HOUSE—a new landmark among the modern office blocks of London—stands on the site of the old Stoll Theatre. Situated centrally between the City of London and the West End, it faces Kingsway on the south-west, and on the north and east overlooks Lincoln's Inn Fields and the Law Courts. It is a seven-storey building with 92,000 sq. ft. of office accommodation furnished and equipped in the most modern style. The building has two basements for car parking.

Until 1960 the London address of the GKN Group of Companies was 66 Cannon Street, E.C.4, where only a limited number of representatives of Group companies were housed; other companies had offices in many different parts of London.

It was the wish of the GKN Board of Directors to bring together in one building all existing London offices in order to serve the needs of the Group and its customers at home and from overseas with maximum efficiency and satisfaction and to provide amenities and working conditions for their staff of such a standard that as a building it will retain its modernity in years to come.

MERGER OF PETBOW AND VERNONS INDUSTRIES

PETBOW LTD., Sandwich, Kent, announce that they have taken over Vernons Industries Ltd., Liverpool factory and all the manufacturing rights on their range of aircraft ground starting and servicing equipment, high frequency alternators, convertors, etc.

During the last ten years Vernons have built up a considerable business in the design and manufacture of all types of 400-cycle aircraft ground servicing and starting equipment for all the latest fighting service aircraft as well as civil aircraft, together with a wide range of equipment for the testing of aircraft, generators etc. when removed from the aircraft, and such equipments are installed at London Airport.

Over the last ten years Petbow Ltd. have concentrated on production of both mobile and stationary a.c. generating equipment from 3 to 500 kW., most particularly using the full range of Rolls-Royce engines where possible, covering a range of from 60 to 350 kW., together with the new range of marine generating sets which have already been ordered for a number of ships. These vary in outputs from 60 to 250 kW. in both d.c and a.c. 50/60 cycle outputs.

With this new merger both factories will be able to benefit from the experience of the other, and also in many instances each factory will be able to manufacture equipment for the other for which they are better equipped to handle on a large quantity basis.

EXPANDING USE OF GALVANIZING

OVER 1,200,000 metric tons of zinc (40 per cent of the total world consumption) were used for galvanizing in 1960 according to reports by delegates from all over the world at the 6th International Galvanizing Conference at Interlaken. About 6 per cent of the world's steel production is estimated to be hot galvanized to prevent it from rusting.

In 1960 the European industry for the first time consumed as much zinc for galvanizing as the U.S.A.—approximately 320,000 tons. In the U.S.A. the galvanizing of sheet and strip took over half and nearly three times as much as general galvanizing. In Europe, only Belgium and France used more zinc for sheet and strip than for general galvanizing which is the largest use in most European countries.

A major development in Europe is the increase in the galvanizing of structural steel, much of it by new specially built plants. Railway electrification schemes and power transmission lines are now big users of galvanizing in most countries and are setting a pattern which building and other industries are beginning to follow.

From the U.S.A. came news of the widespread adoption of galvanized strip by the automobile industries for body construction especially for underbody panels.

Everywhere the use of galvanized strip is expanding and a further substantial rise in the consumption of zinc for galvanizing is forecast for this year when new strip galvanizing lines under construction in Europe and other countries begin production.

BISRA CONFERENCE

BISRA Metallurgy Division announces a Conference ("Hydrogen in Steel") to be held at Harrogate from October 11 to 13, 1961. The specific aspects of the problem to be discussed include: (1) removal of hydrogen from liquid and solid steel; (2) the diffusion and solubility of hydrogen in steel; (3) the effect of hydrogen on the properties of ultra-high tensile steels; and (4) hydrogen in weld metal.

Full details and application forms will be available from August 14, when applications should be made to the Technical Secretary, Metallurgy Division, BISRA, 11, Park Lane, London, W.1.

EXHIBITION OF WELDING EQUIPMENT

A THREE-DAY exhibition of recently introduced welding equipment and practices has been held at the main depot of Thos. P. Headland Ltd., Melon Road, London, S.E.15. The facilities for close inspection, demonstration and personal handling of the equipment were greatly appreciated by the many guests who visited the exhibition.

The main exhibits which were being operated included the new Oerlikon Citofil CO_2/argon gas-shielded arc-welding equipment, gas welding and cutting equipment by British Oxygen Co. Ltd., together with gouging and descaling equipment by the same manufacturer, a range of portable spot-welding machines provided by A.R.O. Machinery Co. Ltd., a semi-automatic, foot operated, butt-welding machine manufactured by Meritus (Barnet) Ltd., radiant heating plant by Radio Heaters Ltd. and the Schember and Sohn magnetic flaw detector.

Static exhibits covered a wide range of welding equipment and accessories, including positioning and holding devices made by Donald Ross and Partners Ltd., Wolf and Black and Decker portable electric tools, Pulsafe shields and goggles, electrode holders, temperature sensitive pigments and a variety of welding transformers including the ESAB lightweight range.

CHAIRMAN OF BEAMA SECTION FOR 21 YEARS

MEMBERS of the BEAMA Arc Welding Electrode Section have presented a Persian carpet to mark the service to the industry of Mr. W. W. Watt, C.B.E., who became the first Chairman of the Section when it was formed in 1939 and continued in that office until his recent retirement.

Mr. Watt was managing director of the British Oxygen Co. Ltd. (whose associated companies include Quasi-Arc Ltd.) from 1937-56, when he retired from active business. He was President of the Institute of Welding in 1941 and President of the British Acetylene Association in 1942. An original member of the Advisory Business Panel (Organisation and Methods) to the Treasury, Mr. Watt has also been connected with the Admiralty and other Government Departments.

VITREOUS ENAMELLERS JOIN PROMOTIONAL COUNCIL

THE Vitreous Enamellers' Association, for 25 years the industry's trade association, has joined forces with the Vitreous Enamel Development Council, the industry's promotional body. Its members, in the Association's new role, will form a Jobbing, Signs and General Division of the Council.

This brings the number of the V.E.D.C.'s Divisions up to five, the others being Architectural, Hollow-ware, Aluminium and Frit and Raw Materials, and its membership to over 60 companies.

In order to make possible the fusion of the two organizations, the V.E.D.C. altered its constitution to admit corporate bodies as members. The secretary of the new division is Mr. C. Hardeman Smith, secretary of the V.E.A., 96 Hagley Road, Edgbaston, Birmingham, 16. Correspondence on promotional matters should be addressed to Commander Geoffrey Clarke, general manager of the V.E.D.C., 28 Welbeck Street, London, W.1.

CONFERENCE ON ANODIZED ALUMINIUM

THE Aluminium Development Association, with the University of Nottingham Department of Metallurgy, is organizing a residential conference at the University from September 12 to 14, 1961. There will be technical sessions on the afternoon of Tuesday, September 12, and morning and afternoon sessions on Wednesday. The conference will end officially after breakfast on Thursday.

The aim of this conference is twofold :—(a) To provide an opportunity for anodizers, users of anodized aluminium, and the industry generally to discuss the latest technical developments, and (b) to give research workers in this field an opportunity to discuss the fundamental aspects of their subject.

Fifteen papers, by British and foreign authors, will be presented. They will be grouped into six sessions under separate headings, and to make the best use of time available will be printed and distributed well before the conference.

Forms of application, containing full details of fees, times, etc., can be obtained from The Secretary, The Aluminium Development Association, 33, Grosvenor Street, London, W.1.

£1¾ MILLION FACTORY IN 12 MONTHS

THE contractors, Holland and Hannen and Cubitts (Scotland) Ltd. have just started work on the half-million sq. ft. single-storey factory for Pressed Steel Co. Ltd. at Linwood, Paisley, and there is also to be a three-storey section, part of a paint-mix-house. The single-storey section will house assembly shop, paint shop and trim shop for the production of automobile bodies for the Rootes Group.

The three-storey section will be designed and constructed by Cubitts in reinforced concrete. The remainder of the factory will have a structural steel frame with brick external walls, vertical patent glazing, metal-deck roof and patent glazing to the monitors.

The architects are Harry W. Weedon, F.R.I.B.A. and Partners and precise planning of the construction programme will ensure completion within 12 months.

A NEW BISRA RESEARCH SECTION

THE British Iron and Steel Research Association has created a new section in its Plant Engineering and Energy Division to centralize the Association's research into control engineering.

When the Plant Engineering and Energy Division was formed, an Electrical Engineering Section was included to carry out research into the electrical equipment used in steelworks. During the last few years, and with the increasing interest being shown in automation in the iron and steel industry, the research of the section has tended more and more towards the electrical engineering aspects of automatic control systems—their design, construction and application to steelworks plant. Some work on hydraulic control systems has also been carried out in another section of the Division. The basic theory of control applies to both, and the one selected depends upon the specific requirements. In view of the advantages to be gained in bringing all the work in the Division on control engineering within the province of one section, the Electrical Engineering Section has been replaced by a new Control Engineering Section.

The Association has appointed Mr. J. P. Clyne, M.A., A.M.I.E.E., Grad.I.Mech.E., who has recently joined BISRA from the Sperry Gyroscope Co. Ltd., as head of the new section.

NEW PLANT and EQUIPMENT

A monthly review of new machines, equipment, processes, etc., of interest to the producer and user of sheet metal

Arc Welding Torches

INTERLAS LTD. of Ampthill, Bedford, are now marketing in Great Britain the full range of products of the Tec Torch Co. of U.S.A.

This range includes air-cooled and water-cooled argon welding torches in both pencil and angled types for manual welding, machine torches for automatic welding and spot guns with control units for TIG spot welding.

Features of these argon torches are the very light weight (only 3 oz.) and the patented transparent Vycor nozzles, which allow unrestricted visibility of the work and are claimed to save 20 per cent argon gas consumption. Pencil models can be fitted with 45 deg. and 90 deg. angled nozzles in addition to straight nozzles. As they use only 3 in. long tungsten electrodes which can be used down to the last $\frac{1}{2}$ in., the overall height of the torch in use is reduced to an absolute minimum for easy access inside small diameter tubes and other such confined spaces.

Air-cooled models can be supplied in either 100 amp. or 130 amp. capacities, while water-cooled and machine torches are of 350 amp. capacity.

The high rating of the water-cooled models, combined with their small size (1 in. dia.) and light weight, is made possible by the design which permits the circulation of cooling water right to the tip of the torch, obviating any cooling-off time. Machine torches 9 in. long with a 24 or 32 pitch rack can be fitted to any existing oxyacetylene cutter or provide a fully automatic welder, using standard Tec interchangeable nozzles, chucks and hose assemblies.

Zippered asbestos covers are available to protect the cable assemblies from cuts, burnthrough and leaking of gas and water supply lines.

The Tec spot gun is a water-cooled 350 amp. portable tool which will spot-weld stainless-steel, mild-steel, nickel alloys, brass, copper, copper Monel, Inconel, etc., up to $\frac{1}{8}$ in. thickness from one side only to a second piece of material of any thickness. The strength of the weld is said to be equal to that of resistance spot welders. The feeding of argon gas and water coolant right to the leakproof head of the gun ensures continuous spot welding, even at the full 350 amp.

Eight standard locators accommodate all types of joints—"T", lap, butt, inside and outside flanges, inside and outside corners, multiple pile up, etc.

The gun can be operated from any ac/dc Tig welder with spot gun controls, a dc generator or rectifier with Tec spot controls, or an ac/dc Tig welder and Tec spot control Unit.

Fig. 1.—Arc welding torch

Shore Hardness Testers

SINCE its introduction 54 years ago the Shore hardness scale has become as well-known as that of Brinell, and the measuring instrument, the scleroscope, more widely used in industrial mass production and engineering than any other instrument.

Two instruments are marketed on behalf of the Shore Instrument and Manufacturing Company of New York by their sole agents for the United Kingdom and the Commonwealth (except Australia) Griffin and George (Sales) Ltd., Ealing Road, Alperton, Middlesex.

The new Shore Scleroscope Model C.2 is an improved, direct-reading instrument, simple and fast in use for the testing of thin metal sheets such as hardened steel (from 0.006 in. thickness), cold rolled unannealed brass and steel (from 0.010 in.), and annealed sheets (from 0.015 in. thickness).

It is also suitable for the testing of chilled iron, forged rolls, gears, axles and other machined parts.

The great advantage claimed for industrial production, particularly where finished polished surfaces are concerned, is that the diamond hammer used leaves no impression visible to the naked eye even on strip with a mirror finish. Conversely, tests can be carried out on unpolished surfaces.

The Model C.2 may be used freehand and this enables inspection to be made anywhere along a production line and on material on machine tools, in presses and so forth.

For continuous quality control at selected stations on the test bench the instrument can be held in clamping stands, swing-arm clamps or roll testing stands. Conversion table to Brinell and Rockwell C scales is available.

The Model D scleroscope substitutes a dial and pointer for the reading of hardness numbers instead of the vertical scale behind the hammer tube. The dial, being

also graduated in Brinell and Rockwell C hardness numbers, facilitates direct reading in any of the three scales desired.

The makers say it will test all the materials for which the Model C.2 is suitable, such as razor blades, large die blocks, shafting, crankshafts, machine tool ways, railway wagon wheels, etc. It is not recommended, however, for use freehand. A selection of clamping devices are available.

Spray Gun

ALFRED BULLOWS AND SONS LTD., Long Street, Walsall, announce the introduction of a new spray gun and a completely new range of "FF" fine finishing nozzles for use with the Graco airless Hydra-Spray equipment, for which they are sole U.K. distributors.

Designed to increase efficiency and reduce operator fatigue, the spray gun is known as the Hydra-Spray "Golden" gun (Fig. 2). It is a lightweight gun whose new rotary action packing eliminates leaks. Very light trigger pressure gives an immediate, precise spray pattern and there is no "lag" to cause spitting.

The advantages claimed for the new "FF" nozzles are that fine finishes can now be applied with feathered edges, thus enabling passes to be lapped; lower air pressure is required to operate the Hydra-Spray pressurizing pump than was previously necessary, and finally, the "FF" nozzles can apply thinner coatings than have so far been possible. There are 17 "FF" nozzles, covering the complete range of fine finishing applications.

The gun is equally efficient for high volume fine finishing or protective coating work, and the single hose enters the gun handle for improved balance; furthermore, coupling of the hose to the gun is by a special swivel attachment which gives the operator more freedom with less fatigue. A further feature is that the gun incorporates a tungsten carbide fluid valve and seat.

Fig. 2.—Spray gun

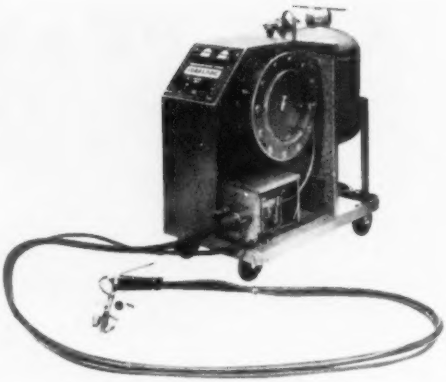


Fig. 3.—Submerged-arc squirt welder

Submerged-Arc Squirt Welder

THE new "Idealarc" ML-3 mechanized submerged-arc squirt welder (Fig. 3) is a versatile semi-automatic unit. Wire and flux are continuously fed to the welding gun from the flux container and reel mounted on the unit. The gun is traversed automatically by a small variable-speed motor mounted on the gun itself, driving a small wheel. Speed variations from 0 to 70 in. per min. can be made.

The ML-3 welder enables an operator to carry out both butt and fillet welding on plate thicknesses from as thin as 10 gauge or $\frac{1}{8}$ in. to the largest sections normally being fabricated. Welding speeds in general will be from two to three times faster than normal hand welding and there is no need for the complicated handling equipment associated with fully automatic processes.

This unit is manufactured by the Lincoln Electric Co. of Cleveland, Ohio, U.S.A. and is marketed in this country by Armco Limited, 76 Grosvenor Street, London, W.1.

Arc Welding Electrode for Mild Steel

PHILIPS announce a new general-purpose electrode for the welding of mild steel which will provide weld deposits of regular appearance in downhand, vertical, overhead and in inclined planes. This electrode, known as type 28, is the latest addition to the Philips range and assists the welder in producing quality welds which are virtually self-deslagging and of excellent appearance. The makers say, it will cope easily with all types of weld joints—fillet, butt, lap and external corners, etc., in all positions which arise in fabrication of mild steel in all thicknesses, having remarkable tolerance of bad fit-up.

A feature of this electrode, is that the stability of the arc is such that in addition to this first-class control over the weld pool in position welding, touch welding techniques may be adopted by the operator, and the "quiet arc" action of the Philips 28 will produce welds of the "classic" profile normally associated with modern contact electrodes.

The type 28 electrode complies with B.S. 639 (1952) and is supplied in four gauges—12, 10, 8 and 6 s.w.g. It may be used on either a.c. or d.c.

Further information can be obtained from the sole distributors in the U.K. Research and Control Instruments Ltd., Instrument House, 207, King's Cross Road, London, W.C.1.

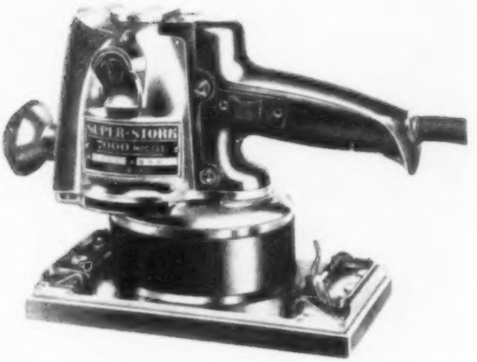


Fig. 4.—Orbital sander

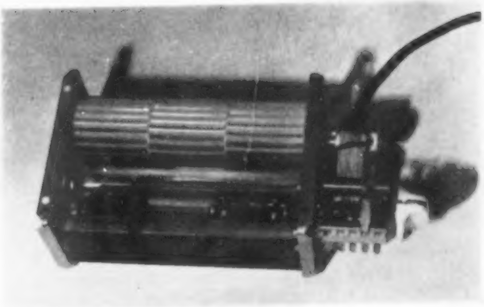


Fig. 5.—Tangential fan

Orbital and Disc Sanders

OF considerable interest to panel-beaters, garages, metal workers, welders and fabricators, stove enamellers, etc., are sanders by Rupes of Milan.

The "Super Stork" 7000 orbital sander (Fig. 4) is claimed to possess many unique features, one of which is that it can be used WET. The makers claim also that it is a more powerful ($\frac{1}{3}$ h.p.) and faster machine (7,000 r.p.m.) than similar machines on the market and is lighter in weight at only $7\frac{1}{2}$ lb. Other advantages claimed include double insulation, proof against vibration, can be used to full effect on curves and shapes and will not slow down under pressure. Other factors attributed to the "Super Stork" are that it performs work which hitherto has had to be done by hand, coupled with its orbital motion which ensures a satin-smooth finish and proof against tracking, scoring or burning.

A few applications to which this machine may be put include rubbing down and flatting work in the motor trade, final finishing of metalwork, welds, etc., linishing of aluminium and other metals and flatting in stove enamelling.

The vertical Model "S.M.10" disc sander also has unique features, the most important being that it can be easily adapted for boring, the equipment for which is supplied with many other extras, with the sander.

With this machine greater power at 1 h.p. under normal loading conditions is claimed.

Perfect balance is also a feature; the operator carries a minimum of weight which, due to the design of the machine, is distributed over the working surface, thus reducing fatigue and permitting easier access to awkward places, plus safety in handling. The "S.M.10" operates at 4,200 r.p.m., will not vibrate or slow down and is so designed that twisting out of the operator's hand is not possible. Furthermore the operator is protected by a steel guard and insulated handles for maximum safety. Some of the applications of this machine include: ripping out, grinding, scurfing panels after beating, scurfing lead and welds, sheet metal work, paintwork, etc.

The sole concessionaires for Great Britain are Marron Machines Ltd., 2 Newark Parade, Watford Way, London, N.W.4.

Tangential Fan

RECENTLY demonstrated in London by The Solartron Electronic Group Ltd., (a member of the Firth Cleveland Group), was a new fan (Fig. 5) based on the tangential flow principle of air circulation. The fan may be incorporated in heating, cooling and drying devices.

The principle of tangential flow is that a silently spinning vortex of air is set up with its centre just inside the impeller. The periphery of this vortex picks up inflowing air and moves it past the blades at high speed, a higher speed than the peripheral velocity of the impeller blades which draw it in.

When used for heating, the fan directs the stream of directional non-turbulent air through the heating elements at the output duct of the heater from which it emerges in a smooth long, powerful flow from which it travels at least 15 ft. before being broken up by convection. The heating element, formed as a helix of edge wound metal ribbon and supported on an insulating cradle, is operated only at black heat yet generates over 2 kilowatts of heat.

Numerous uses are envisaged for this fan ranging from cooling for electronic equipment to a car heater. Enquiries should be made to the Solartron Electronic Group Ltd., Farnborough, Hants.

Epoxy Coating

LEWIS BERGER (GREAT BRITAIN) LTD. have developed a solventless epoxy coating, a two-pack cold cured system.

Its main end use is in the specialist building, chemical, chemical engineering and petroleum industries for the protection of plant and structures and also tanks and pipelines which are exposed to severe chemical attack. It is particularly suitable in the marine field for the protection of cargo and ballast tanks, the coating of deep tanks and fuel and freshwater tanks.

The coating is most suitable for steel and concrete surfaces. Steel should be grit blasted, clean and dry, and concrete clean, dry and free from surface dust.

Because there is no carrier solvent, thick films of up to 20 thou. are claimed to be achieved, with extreme chemical resistance and high mechanical properties. Unlike conventional epoxy resin systems, which might need up to four coats to achieve 5 thou. film thickness, this new solventless formulation can achieve 20 thou. when required, with one application.

A further advantage claimed is that when painting in confined spaces such as tanks, the forced air circulation required when using conventional epoxys (to remove solvent vapours) is not necessary. It is, however, necessary for the user to employ breathing apparatus or similar protection under such extreme circumstances.

With proper surface preparation its adhesion to both steel and concrete is excellent.

The colour is pale cream and application is by brush or spray. Drying time is four to eight hours and full cure time is about seven days.

Spreading rates are 35/40 yds. per gallon at 5 thou. thickness, 15/20 yds. at 10 thou thickness and 8/10 yds. at 20 thou. thickness. The pot life is about one hour at 65 degrees Fahrenheit.

Fig. 6 (left).—Electrode holder

"Air Insulated" Electrode Holder

SPECIALLY designed and developed to combat heat generated during heavy welding operations at high duty cycles, the Courtburn "Air Insulated" 600-amp electrode holder (Fig. 6) is claimed by the manufacturers to be the most advanced of its type available, while remaining light and easy to handle.

In the construction of the body two circular distance pieces made from heat-resistant material separate the cable, cable connexion and plunger from the handle. Consequently, the heat generated by current passing through the cable is dissipated by an insulating barrier of air; operators can therefore maintain continuous welding without suffering discomfort. The "Air Insulated" electrode holder thus provides greater efficiency and economy.

Available from Courtburn Supplies Ltd., Kempston Hardwick, Bedford.

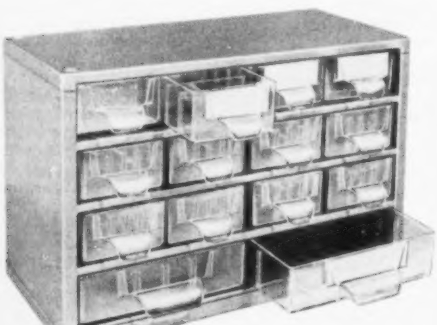
Storage Cabinets

A NEW addition to the standard range of the Raaco industrial cabinets, for the storage of small items, is the 14-drawer unit, 7⅞ in. high × 12¼ in. wide × 5¾ in. deep (Fig. 7). This small storage unit has transparent toughened plastic drawers, adjustable by sub-dividers to give 54 separate compartments.

The drawers are contained in a sheet-metal cabinet with a grey hammer finish, and the cabinet itself can be stacked or fastened to the wall. Apart from its versatility for individual bench units, extensive compact storage installations can be assembled with larger sized Raaco units, all standardized on width and depth.

Further details and illustrated leaflets are available from James H. Randall and Son Ltd., Paddington Green Works, London, W.2.

Fig. 7.—Industrial storage cabinet



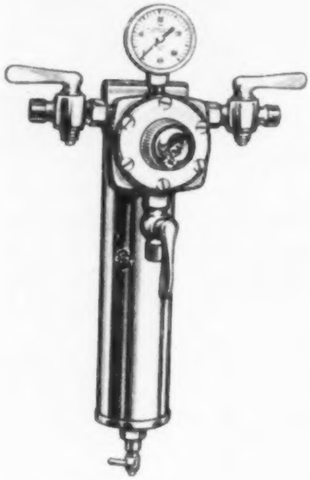


Fig. 8 (right).—Air transformer

Air Transformer

THE HLE air transformer (Fig. 8) introduced by The Aerograph-DeVilbiss Co. Ltd., 47 Holborn Viaduct, London, E.C.1, is designed to provide steady, non-fluctuating delivery of cleaned air to all types of air tools. Pressure regulation is controlled within ± ¼ lb. per sq. in. for each 10 lb. per sq. in. fluctuation in the main line pressure: the capacity of the transformer is 50 cu. ft. per min., the maximum regulated pressure is 135 lb. per sq. in. and the maximum main line pressure is 250 lb. per sq. in. When used in spray painting, the transformer will provide two large production spray guns with a constant supply of clean air at the required pressure. An all-metal centrifugal type oil and water eliminator is fitted, requiring no replacement or maintenance, and a special composition filter, which lasts indefinitely, can be easily removed for inspection and cleaning. A simple drain valve is provided to discharge accumulated water and oil.

Synthetic Enamel

A NEW "One-hour" synthetic enamel has been produced by Teal and Holmes Ltd., the Hull paint firm. Marketed under the trade name "IMPERVIOUS" this new paint is supplied in both brushing and spraying qualities in a wide range of colours and gives good coverage. Dust dry in approximately 15 minutes and hard dry in an hour, it provides an economical, full gloss, tough and flexible film with excellent adhesion, particularly to aluminium sheet, without previous priming. Claimed to be particularly suitable for application on metal, it has already been exhaustively tested on caravan exteriors, and suitable also for agricultural machinery, vehicle bodies, industrial trucks and all manner of machinery and metal constructions.

27 Lee Wilson Open Coil Plants

Photograph by courtesy of Empire-Reeves Steel Corporation, Ohio, U.S.A.

The principle of gas alloying has been understood and accepted by metallurgists for several years—but now the LEE WILSON OPEN COIL PROCESS makes this a commercial proposition.

Now it is possible to remove carbon at the annealing operation, enamelling sheets that require but a single coat of enamel can be made from regular rimmed steel sheet. By removing carbon and nitrogen, economic and high quality non-aging rimmed steels can now be made.

This is a revolutionary step in steel processing which you can learn more about by contacting:—

This process is being accepted by the world's steelmakers. Plants are being installed in different parts of the world including Japan, Europe, U.S.A. and Canada. 27 Plants have been ordered, many of which are in production.

INCANDESCENT

THE INCANDESCENT HEAT COMPANY LIMITED, Smethwick, England

British licensees for the Lee Wilson OPEN COIL PROCESS

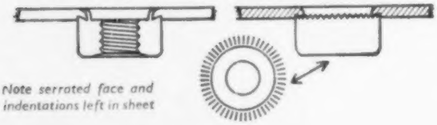
16/21C/61

Wunop

Patent applied for No. 31597/57

RIVET BUSH

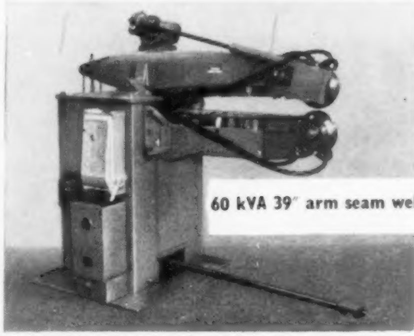
New type permanent insert bush single blow fixing. Suitable for sheet metal, plastic or plywood, All threads up to ½in.



Note serrated face and indentations left in sheet

BENTON ENGINEERING CO. LTD TONBRIDGE ROAD, HAROLD HILL • ESSEX
Phone: Ingrebourne 43864 & 43865

Seam Welders



60 kVA 39″ arm seam welder

Welds 16 gauge M.S. Sheets at 4½ ft. per min.

- Self-contained motor drive.
- Variable mechanical pressure.
- Primary tappings on transformer for wide range of secondary voltage.
- Straight and circular seam welders available, giving air-tight joints to stand high pressure.

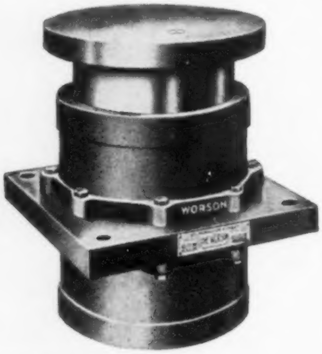
ALSO PATENT SCALING MACHINES AND SPOT WELDERS

Write to-day for full particulars

THE **WESTMINSTER ENGINEERING Co. Ltd**
(Dept. R.W.S.)
Victoria Road, Willesden Junction, London NW10
Tel: ELGar 7372 (2 lines)

WORSON Pneumatic Die Cushions — *FOR* BETTER PRESSINGS

THE UNIVERSAL



DRAWING DEVICE

FOR DETAILS APPLY:—

WORSON DIE CUSHIONS LTD.

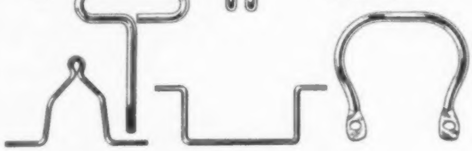
Dept. M., RABONE LANE WORKS, SMETHWICK, STAFFS. *Tel.:* SMETHWICK 0939

BENT *Wire* ARTICLES

FOR THE SHEET METAL & TINPLATE INDUSTRIES

SPECIALITIES

WIRE BAIL AND DRUM HANDLES IN ALL SIZES FOR PAINT, OIL AND OTHER CONTAINERS



BRADLEY & BURCH

WIRE COMPONENTS
LIMITED
65, LONDON WALL, LONDON, E.C.2
PHONE: NAT. 7518 'GRAMS: CLAVIGER, STOCK, LONDON

CLASSIFIED ADVERTISEMENTS

PREPAID RATES: TYPE ADVERTISEMENTS (no blocks) 2/- per line or 24/- per single column inch (12 lines per inch). **Minimum** charge 8/- (4 lines). Average number of words per line 7.

DISPLAY ADVERTISEMENTS (with or without blocks) per single column inch (width 2 ins.) 12 insertions £1. 10. 0. each, 6 insertions £1. 13. 0. each, single insertion £2. 0. 0. (pro rata larger spaces). BOX NUMBER 2/6 including postage of replies.

Advertisements (accompanied by a remittance) and REPLIES TO BOX NUMBERS should be addressed to the Classified Advertisement Manager, "Sheet Metal Industries," John Adam House, 17-19, John Adam Street, Adelphi, London, W.C.2. Telephone: TRAfalgar 6171.

MACHINERY and MATERIALS WANTED

200 TO 300 ton Press. Bed area approximately 6 ft. x 4 ft. with a stroke from 12 in. to 14 in. Full details to: Bristol Metal Components, Ltd., Bristol, 5.

TIN BOX Plant and Presses required suitable for round and irregular containers manufacture.—Modern Packages Ltd., Byass Works, Port Talbot, Glamorgan.

BRAKE Press wanted, approx. 8 ft. 0 in. x 10 gauge. Price and particulars: Jenkins Fidgeon, Ltd., Linley Road, Talke, Staffs. Tel. Kidsgrove 2368.

ATMOSPHERE CONTROLLED Annealing Furnace (second-hand), 6-12 in. conveyor belt, suitable for small medium ferrous and non-ferrous pressings.—Box No. 147, "Sheet Metal Industries," 17-19, John Adam Street, London, W.C.2.

MACHINERY and MATERIALS FOR SALE AND WANTED

PORTABLE POWER TOOLS

NEW, used, bought, sold, exchanged Arthur Drysdale and Co., Ltd., 58, Commerce Road, Wood Green, London, N.22. Bowes Park 7221.

MACHINERY and MATERIALS FOR SALE

BRADLEY & Burch Model CFE. Automatic Curling Machine for sale. Handles from 2 in. to 6½ in. diameter. Chute feed. Arranged motor drive 380/420/3/50. F. J. Edwards, Ltd., 359, Euston Road, London, N.W.1, or 41, Water Street, Birmingham, 3.

INCANDESCENT Heat Gas Fired Muffles for sale.
One Flat Firing Furnace, 7 ft. 6 in. x 3 ft. 6 in. wide x 2 ft. 9 in. deep.
Two Hanging Furnaces, 14 ft. 6 in. x 2 ft. 10 in. wide x 5 ft. 7 in. deep.
Complete with chargers, recording and controlling equipment.
Enquire Entwisle & Kenyon, Ltd., Ewbank Works, Accrington. Telephone 32631.

MACHINERY and MATERIALS FOR SALE—*Cont.*

FOR SALE
Two 255-ton
CRAIG & DONALD 8/35
DOUBLE SIDED GEARED PRESSES

One with air cushion, one without. Stroke 12in. Between uprights 35in. Shut height to bolster 15½in. Air cushion travel 6½in. Motor drive 400/440/3/50. Photograph available.

F. J. EDWARDS, LTD.,
359, Euston Road, London, N.W.1,
EUSton 5000.
or 41, Water Street, Birmingham, 3.
CENtral 7606.

TIME RECORDERS
RENTAL SERVICE
TIME RECORDER SUPPLY & MAINTENANCE CO., LTD.
Hop 2239
157/159, BOROUGH HIGH ST. LONDON, S.E.1

FOR SALE
18ft. x ¼in. RHODES PRESS BRAKE

(or 10ft. x 3/16in.). 150 tons capacity. Motorised 400/3/50. Friction clutch. Motor adjustment to ram. 90° forming tool, 10ft. 2in. long, and bottom die with 1¼in. and 1½in. openings. Bed and top beam solid steel, 18ft. 1in. long. Between uprights 10ft. 2in. Stroke 5in. Die space 12in. Weight about 20 tons.

F. J. EDWARDS, LTD.,
359, Euston Road, London, N.W.1,
EUSton 5000.
or 41, Water Street, Birmingham, 3.
CENtral 7606.

BURFREE 1A Nibbling Machine, 400/440. Capacity 3/16 in., throat depth 30 in. In excellent condition. Can be seen working. £145.—Northfield Engineering, Ltd., 82, Frederick Road, Birmingham. 'Phone SEL 2637.

625 Ton Treble Action Hydraulic Deep Drawing Press by Fielding & Platt, blank holder 72 in. x 63 in., with bottom cushion, self-contained pumping unit with push button automatic operation.
1,400 ton Vertical Downstroke Hydraulic Press by Wellman, bed 72 in. x 96 in., suitable for conversion for drawing work.
21 in. x 39 in. Two-High Hot and Cold Rolling Mill Unit by Taylor & Farley with 300 h.p. drive.
9 in. x 21 in. Foil Mill with 75 h.p. variable speed drive.
Kendall & Gent Scalping Machine for billets 40 in. square.
Write for priced Stock List for current bargains in Hydraulic Presses, Rolling Mills, etc.

REED BROTHERS (ENGINEERING), LTD.
(Mr. C. E. M. Hardie, Receiver & Manager),
Woolwich Industrial Estate, S.E.18.
Tel. Woolwich 7611.

OVERLOCK LIMITED

STEEL STOCKHOLDERS AND SHEARERS

PRECISION CUT BLANKS AND STRIP

Before placing your next order, why not write or phone for our quotation, enquiries large and small welcomed.

Large stocks in all gauges of General Purpose Cold Reduced Steel Sheets. Prime and Seconds. Competitive Prices. Prompt Deliveries.

WHY NOT TRY THE OVERLOCK SERVICE

Ring MALDEN 3215. (5 lines)

61 BLAGDON ROAD, NEW MALDEN, SURREY

LEO RAPP (STEEL) LIMITED
Steel Stockholders

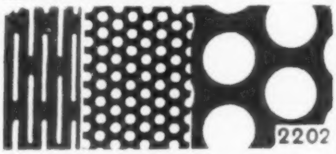
Wimborne Avenue, Norwood Green, Southall, Middx.
Telephone: Southall 2322 Telex: 25172

Mild Steel Sheets, C.R.C.A., C.R.G.P., E.D.D., Zinc Coated, Galvanized. Plates up to 6". Black and Bright Mild Steel Bars, Flats, Sections. Primes and Non-Primes. Capacity for shearing and profile cutting.

Stockholders for JOHN SUMMERS Steel-Sheets

METAL SPINNING OUR SPECIALITY
UP TO 9 ft. DIAMETER
(HYDRAULIC AND FLOW TURNING)
POWER PRESSWORK to 250-ton capacity, including Hydraulic.
GENERAL SHEET METAL WORK, ARGON, ARC & OXY-ACETYLENE WELDING
DEEP DRAWN PRESSINGS
SHAWE METAL SPINNING WORKS
DOMINANT WORKS · ELTHORNE ROAD · LONDON, N. 19 Telephone: ARChway 6431/4
(opposite Boothby Road)

SIZE WISE?
Just right! Specifically designed Stainless Steel fittings by Contemporary Metalworks Ltd.—the experts in the field—can be made to *any* shape or size. If you have a fittings problem, get in touch with Contemporary Metalworks right away. They'll solve it for you!
CONTEMPORARY METALWORKS LTD.
TEL. Shettleston 4221/2 — 61, Dykehead Street, Queenslie, Glasgow, E3.

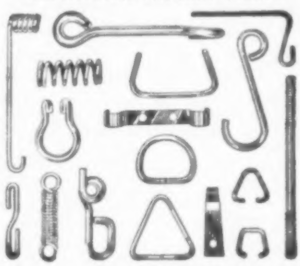


H. GRAEPEL LTD.
KINSALE, CO. CORK, 13
Makers of PERFORATED METAL

SHEET Metal and Light Constructional Engineers require work of a general and varied nature. Capacity available 8 ft. x ¼ in. Box No. 149, "Sheet Metal Industries," 17-19, John Adam Street, London, W.C.2.

PRECISION Sheet Metal Work for the Radio and Electrical Trade. Chassis, Panels, Brackets, etc. Power Press capacity up to 100 tons. Press brake capacity up to 105 tons 8 ft. x 7/32 in. All spray and stove finishes. A.I.D. approved.—The Kaymet Company, Kaymet Works, Sylvan Grove, London, S.E.15. Telephone NEW Cross 6644

BENT WIRE ARTICLES
SMALL PRESSINGS
REPETITION-TURNED PARTS



W. B. & U. ATKINSON, LTD.
Rosse Street Works, Shipley, Yorks.

PRESSINGS
Deep Drawing. Up to 8" Deep
STAMPINGS
Up to 75 tons Pressure
SPINNINGS
Up to 46" diameter
Send your enquiries to:
ELLAND METAL SPINNING CO. LTD.
Phone Elland 2738 — SOUTH LANE, ELLAND

METAL SPINNING
Capacity available for Metal Spinnings up to 150 in. diameter.
A.I.D. and A.R.B. APPROVED
Long or Short Runs
Precision Metal Spinnings
Masons Road, Stratford-on-Avon
Phone: 3895/6

GRUNDY
Specialists in High Quality
SHEET METAL WORK
Offer a service which specialises in design and manufacture to your particular requirements:
GRUNDY EQUIPMENT, LIMITED,
High Street · Cowley · Middlesex · *Tel.:* Uxbridge 38551

WE specialise in slitting your own material in widths from $\frac{1}{2}$ in.-4 in. and gauges from .010 in.-.064 in. and would welcome enquiries for all types of material. Quick delivery guaranteed.

ALEX J. CHEETHAM LIMITED,
Dob Lane Mill, Morton Street, Failsworth, Manchester.

SHEET METAL Fabrications of precision and repetitive nature a speciality.—Wades (Halifax), Ltd, Arden Works, Fenton Road, Halifax.

PRESS WORK of all descriptions carried out. Deep Drawing up to 15 in. deep, Blanking and Forming up to 80 tons.—Wades (Halifax), Ltd., Arden Works, Fenton Road, Halifax.

DYAS & FOWLE

41, LOUDOUN ROAD, N.W.8

Are now able to accept further orders for Steel Sheets, Blanks or Strip cut to GUARANTEED TOLERANCES.

Your own material collected and delivered.

Send us your enquiries or telephone:—
MAI. 8641, 5489, 5477.

DRAKESONS

(GENERAL METAL SPINNERS) LIMITED

CAPACITY UP TO 72" IN ALL METALS

SPECIALISTS IN STAINLESS STEEL HYDRAULIC SPINNING
SHEET METAL ENGINEERS

21 PARKHOUSE STREET, CAMBERWELL
LONDON, S.E.5. RODney 5626/27/28

SHEET & PLATE
SHEARING CAPACITY AVAILABLE

up to 10' × $\frac{3}{8}$" Plate, also cropping of
Channels, Angles, Tees, etc.
Our own or customers' material.

Write or telephone
WELBECK (Steel Stockholders) LTD.
Steel Wharf, River Road, Barking, Essex
Telephone: **Rippleway 5751-4**

METAL SPINNING

STAINLESS STEEL & HYDRAULIC SPINNING TO 6 ft. CAPACITY

SHEET METAL WORK
STOVE ENAMELLING
GENERAL ENGINEERING

Enquiries invited
ALFRED A. CORRE & CO. LTD.
23, JACOB STREET, LONDON, S.E.1
Telephone: Bermondsey 2858

LET US quote you for metal spinnings in all metals up to 25 in. blank.—Wades (Halifax), Ltd., Arden Works, Fenton Road, Halifax.

BOOKS

TIN BOX Engineers and others concerned with sheet metal production problems should have a copy of "Tin Box Manufacture," by J. W. Langton, M.B.E., B.Sc., M.I.Mech.E., obtainable from Canning Publications, 28, Monument Street, London, E.C.3, price 31s. 6d. post free. (Leaflet free).

STAINLESS STEEL
Specialists

FABRICATION, WELDING AND X-RAY INSPECTION, PRESSINGS AND MACHINED PARTS

THE TAYLOR RUSTLESS FITTINGS COMPANY LIMITED
Ring Road, Lower Wortley, LEEDS 12

SITUATION VACANT

FOREMAN required for Steel Stockholding Company, preferably with guillotine and rotary shearing experience, for modern factory in N.18 London district.—Apply Box No. 151, "Sheet Metal Industries," 17-19, John Adam Street, London, W.C.2.

CLASSIFIED
ADVERTISEMENTS
for the SEPTEMBER issue
should be sent to
CLASSIFIED ADVERTISEMENT MANAGER
"SHEET METAL INDUSTRIES"
John Adam House, 17-19, John Adam St.
Adelphi, London, W.C.2.
by not later than
16th AUGUST, 1961

GENERAL TINNERS AND BLACKSMITHS

The **LONDON TINNERS LTD.**
14/22 CRONIN ROAD, PECKHAM, LONDON, S.E.15
TELEPHONE: RODNEY 4569 · TELEGRAMS: LONDTINNERS, PECK, LONDON

INDEX TO ADVERTISERS

AUGUST 1961

**denotes pages numbered in editorial sequence*

Published by the Proprietors, INDUSTRIAL NEWSPAPERS (FUEL AND METALLURGICAL) LTD., 17-19, John Adam Street, London, W.C.2.
Printed in Great Britain by WILLIAMS, LEA & CO., LTD., Worship St., E.C.2. **Registered for Transmission by Canadian Magazine Post.**

Sheet Metal Industries

The only Journal in the World wholly devoted to the Manufacture, Manipulation, Fabrication, Welding, Assembly and Finishing of Ferrous and Non-Ferrous Sheet and Strip

VOL. 38 : No. 412 AUGUST 1961 PRICE 2/6